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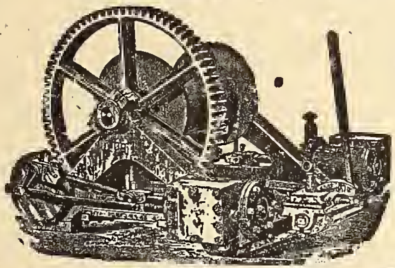

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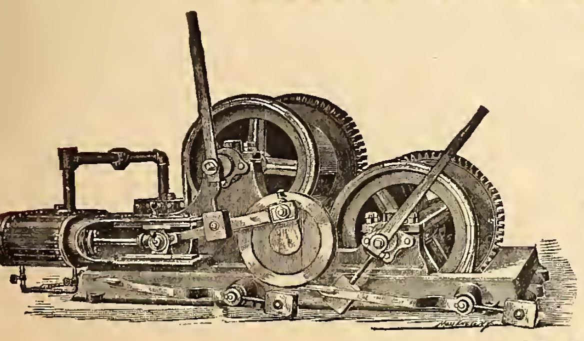

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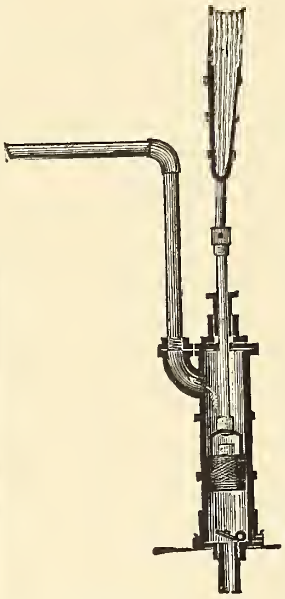

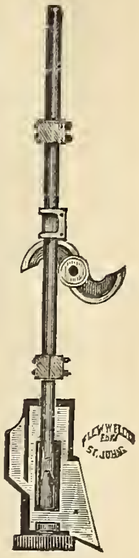

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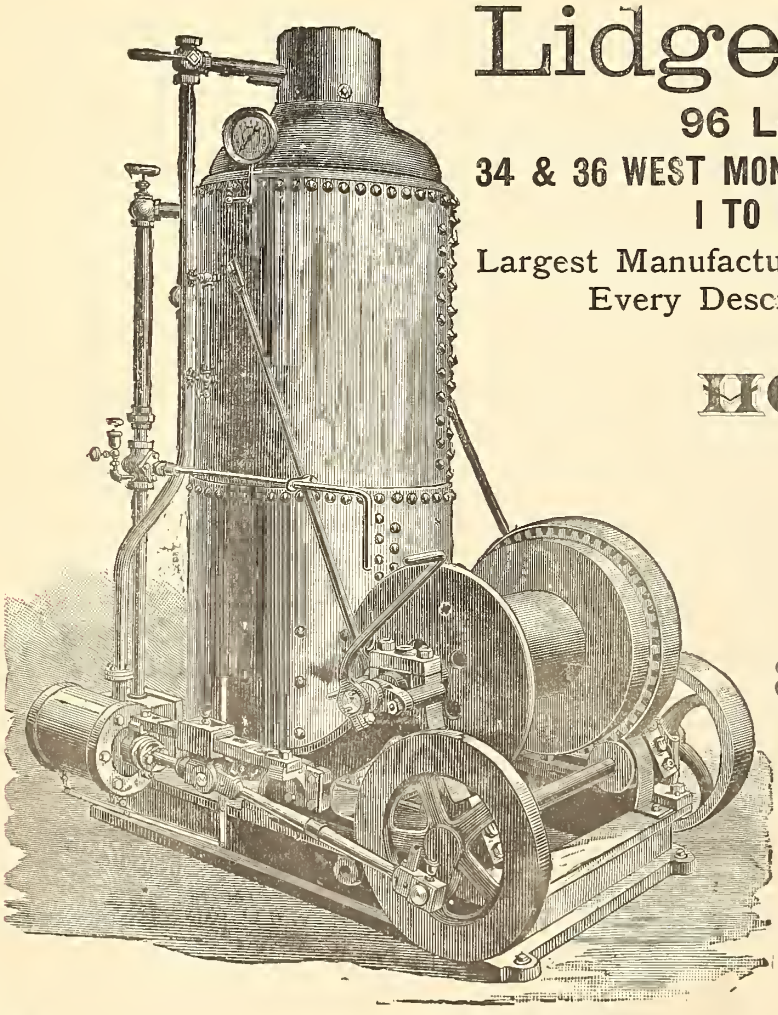

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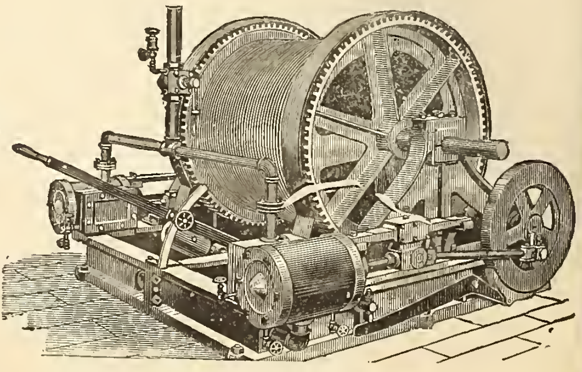

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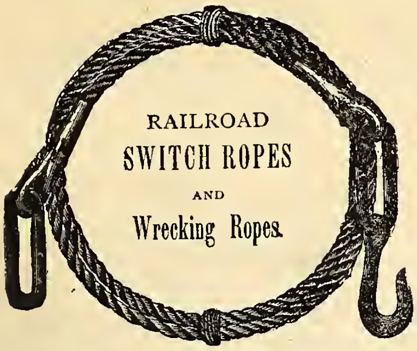

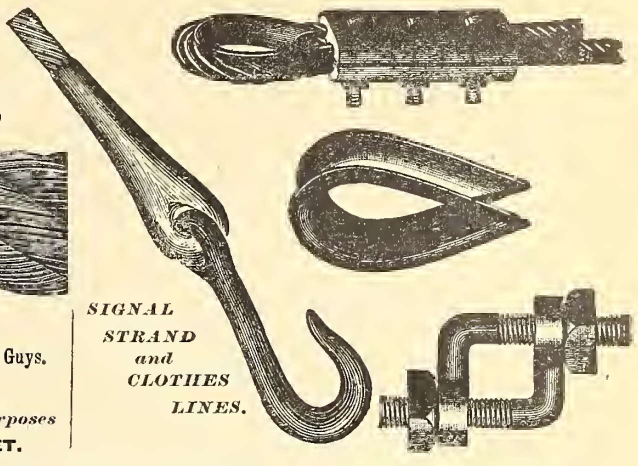

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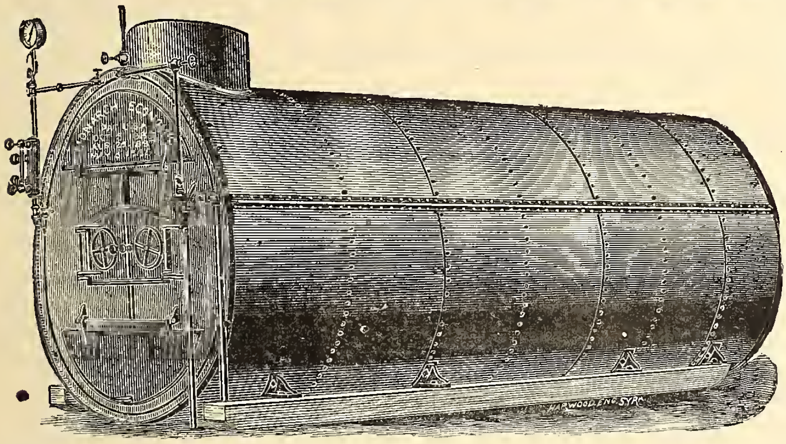

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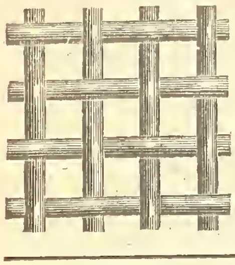

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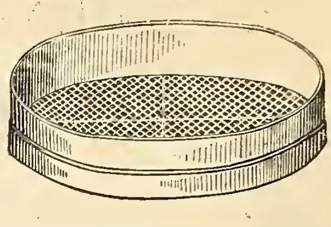

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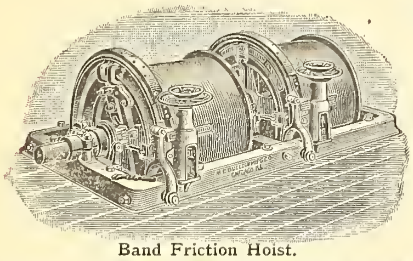

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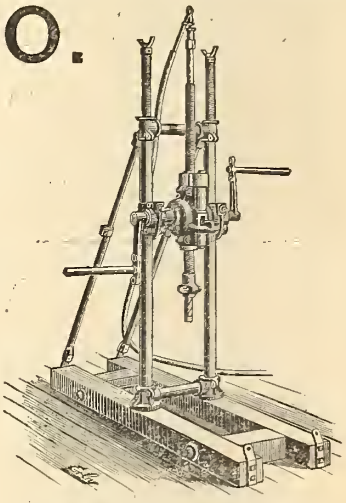

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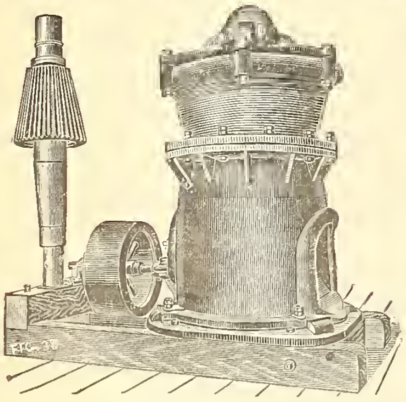

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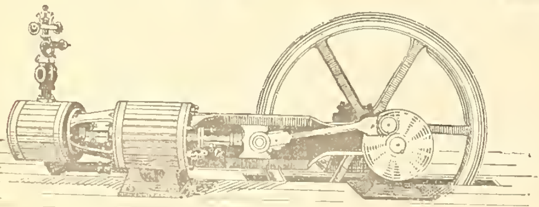

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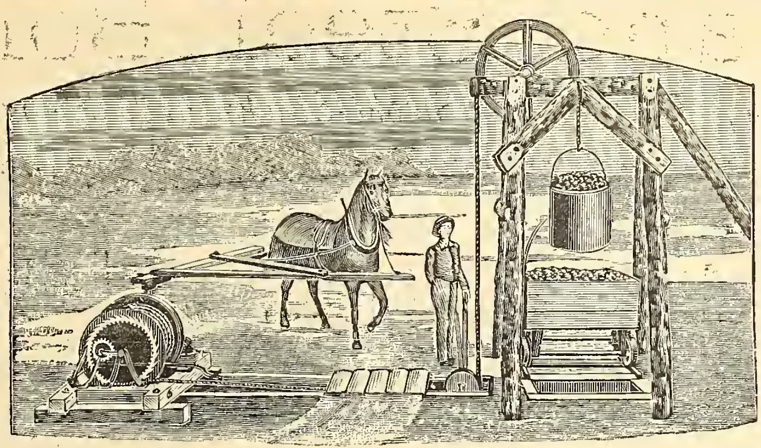

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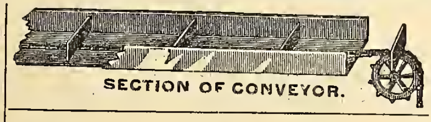

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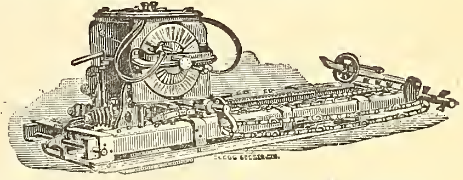

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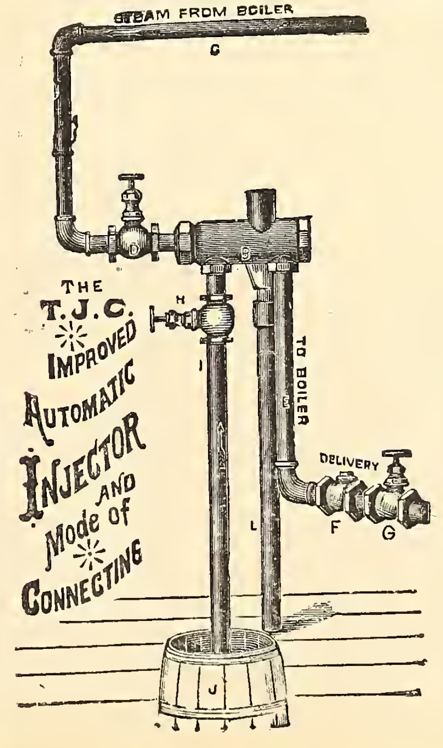
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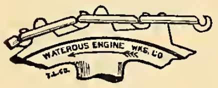
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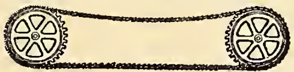

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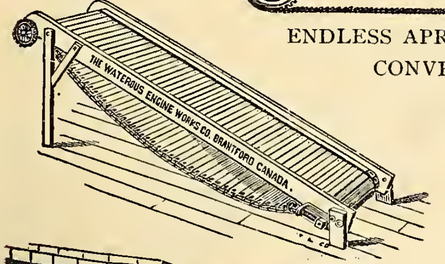
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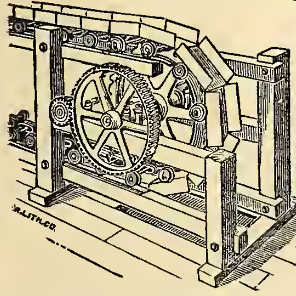

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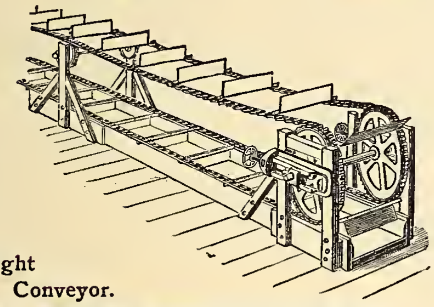

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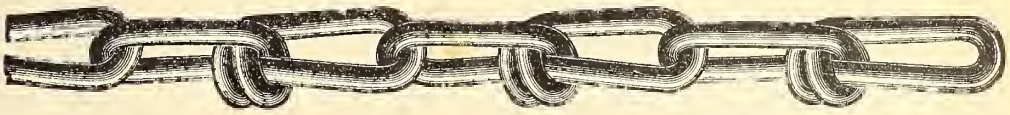

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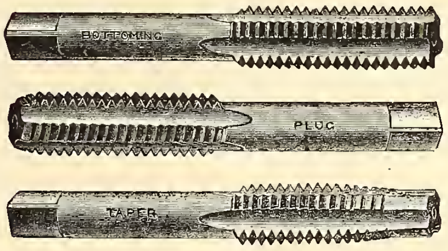

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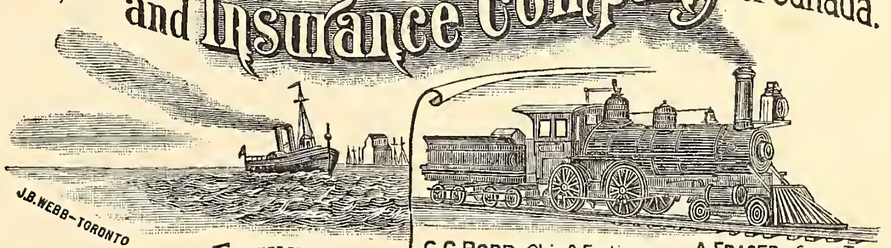

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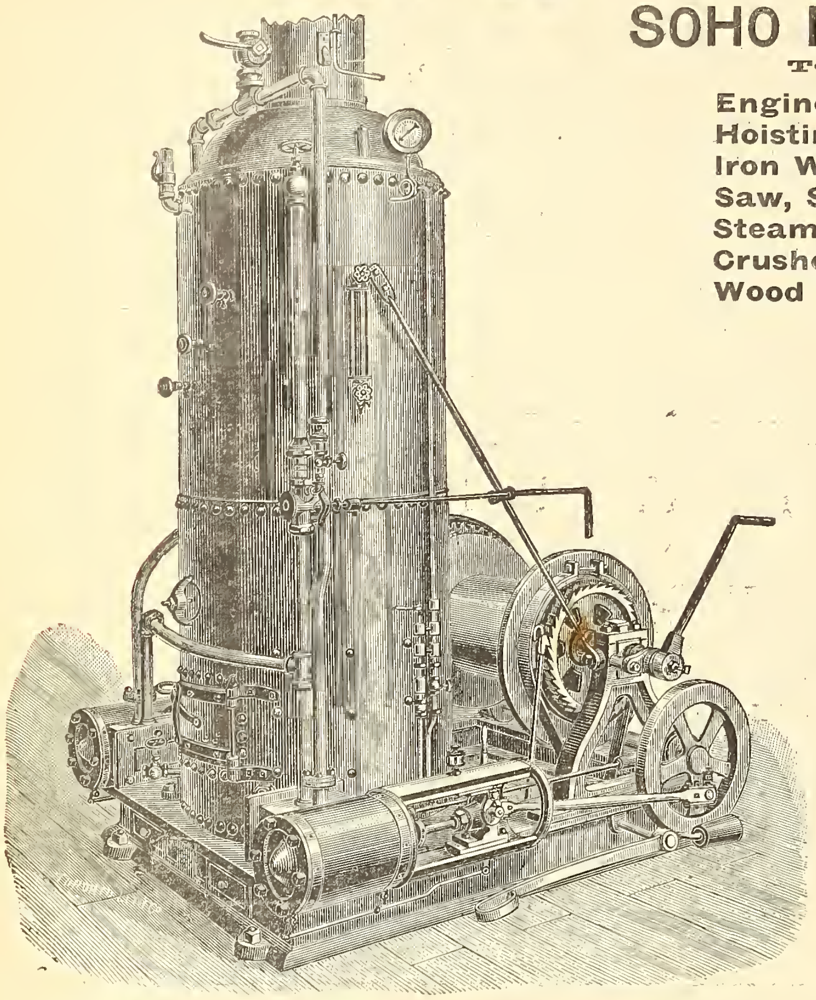

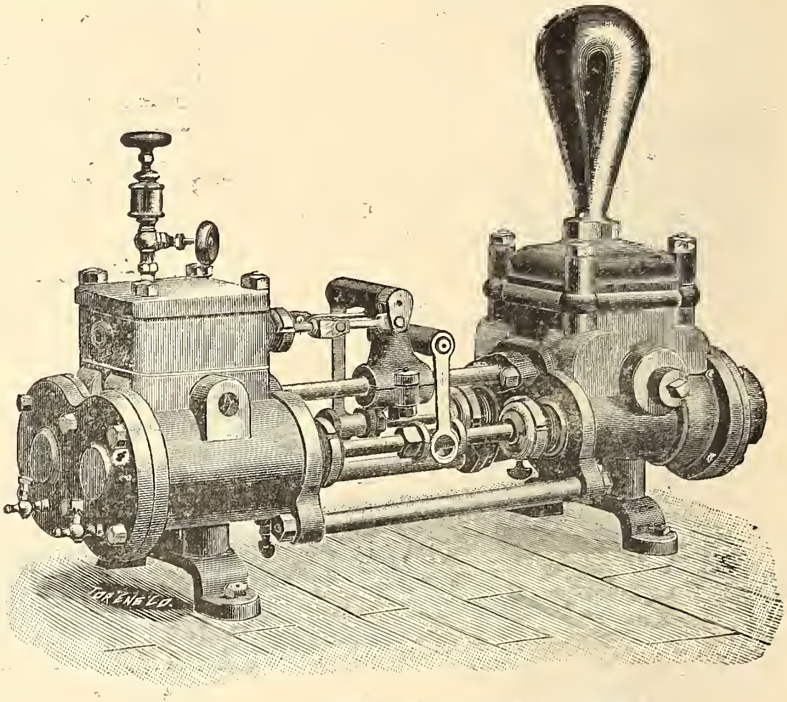

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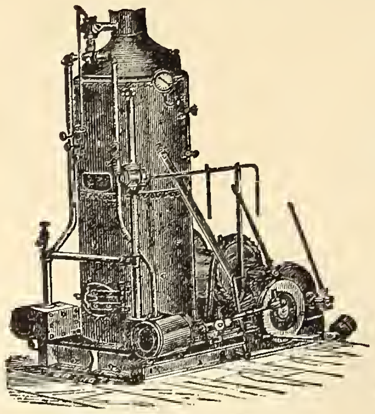

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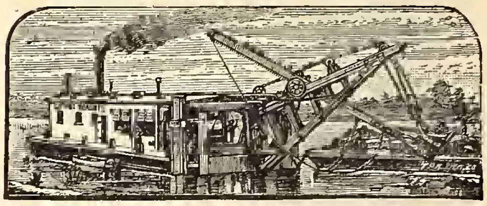

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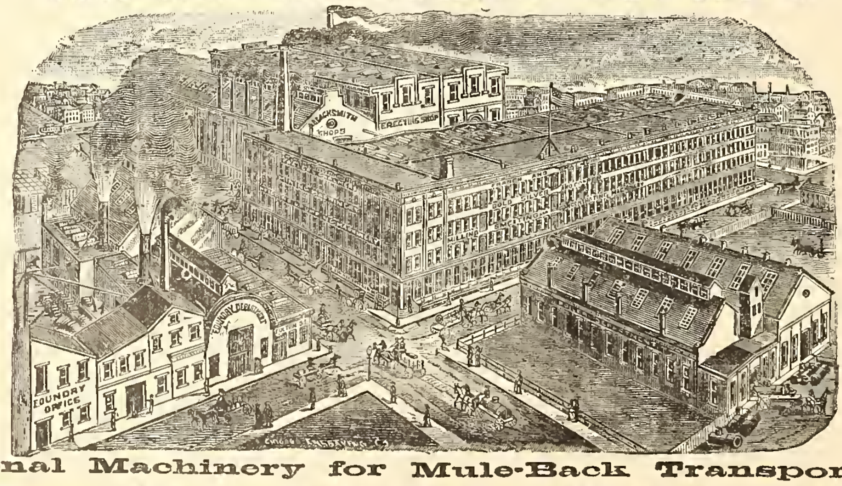

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The Gold Industry of Nova Scotia in 1890.

Full returns from all the gold mines of this Province are not attainable at the hour of going to press owing to the dilatoriness of several companies in making returns, but from the figures accessible it is evident that the total yield will not much (if any) exceed 20,000 ounces for the year. The yield for 1889 was 26,000 ounces, making a *decrease* for 1890 of over 20 per cent.

This large falling off has not been unexpected by persons acquainted with the industry during the last six months, and has not been confined to one or two districts, although the three Queen's County districts of Brookfield, Malaga Barrens and Whiteburn show a shortage of about 4,000 ounces as compared with 1889. Of this amount Whiteburn alone represents one-half, and the cause is due to the closing down of the McGuire mine in December 1889; the decreased yield of the "Philadelphia" and the "Molega" companies accounts for the other half.

Among the other districts reporting decreased yields are,—*Caribou*, producing little more than one half as much as in 1889; *Renfrew*, which reports a decrease of over 500 ounces; and *Stormont*, showing a decrease of over 1,000 ounces. This decrease in Stormont is due to the enforced idleness of the Palgrave company which obtains because of the litigation in which unscrupulous speculators have involved this valuable property.

The districts which have practically maintained their yield are principally Salmon River, Oldham, Uniacke, Montagu and Rawdon, embracing both East and Central Rawdon. Rawdon has maintained its yield on account of the new property opened by Mr. Northup, and on account of the re-opening of the East Rawdon mines in the second half of the year. The older mine in Central Rawdon has practically ceased producing, for the present at any rate. It appeared like a comet in the summer of 1889, was sold in the United States, and all but disappeared, with almost equal celerity, in 1890.

The large district of Sherbrooke shows a gain of less than 100 ounces, the total being about 300. Waverley, after two years preparation and the lavish expenditure of money, reports about 500 ounces. The Egerton Co., on Fifteen Mile Stream, have the best progress to report, having doubled its production in about one-half the year owing to energetic management and improved machinery.

The districts producing 2,000 ounces or over are Oldham, Malaga and Rawdon (East and Central united).

The main cause of the large falling off, this past year has been the old familiar one of lack of development. The rich streaks being gouged out as rapidly as found, there came periodical times of poorer quartz, and in some cases total collapse, as in the Neptune mine at Chester Basin.

The outlook for the coming year is not favorable; several schemes which have been inflated during the past year will be pricked the coming season, and with probable disaster to the good name of the gold industry abroad. Several of the older districts, however, will probably show a large increase, as Salmon River and Oxford, which have been equipping their mines with new mills and improved machinery for development and extraction.

In spite of the lessened production the industry is on a better basis than last year, and out of the extinction of the recent "boom" and "boomers" will come more substantial prosperity and progress.

The Quebec Mining Bill.

If Mr. Mercier desires to convert the Quebec mining men into straight anarchists, he could hardly have devised a better means than the enactment of the new Quebec Mining Law; a measure so full of unjust and vexatious provisions as to induce a contempt for the whole system of legislation under which such annoyances are practicable. Better no law at all than such interference with individual enterprise and such violation of agreements. By reference to our summary of the Act, the main features may be readily grasped; and we will here merely allude in brief to some of the points that appear to us to be especially objectionable.

If purchasers of a mine know beforehand that a royalty of three per cent. is to be levied upon the output, they have the option of investing or leaving the industry alone. But when mines are sold outright and subsequently a royalty is imposed, there is a breach of contract committed which constitutes a moral outrage, and we should think a legal offence. If our working mines were now owned by the original purchasers at the low government prices, there would not be so much reason for complaint; but in nearly every case the operating companies have purchased their lands at such high prices that, as a rule, it is difficult for them to earn profits in excess of the interest upon capital. They paid these prices with the supposed guarantee of freedom from royalty or they never would have paid them. If the tax was levied upon profits, instead of upon the output irrespective of its cost, it would be less open to the charge of injustice and less likely to be injurious in its effects upon struggling enterprises.

The appointment of inspectors with unlimited powers will create an offensive oligarchy, whose unappealable decisions will cause a vast amount of ill feeling and vexation; and if unsuitable persons are appointed, as is certain sometimes to be the case, a great deal of injustice will be perpetrated.

The right of the owner of the soil to have the option of buying the mineral rights, after their value has been discovered by the explorer, will put a check upon research and discovery; and the power of the commissioner to advance the price of lands,, or put them up to public auction, will be a discouragement to the prospector and often work a great injustice, allowing the rich idler to appropriate the efforts of the poorer, active explorer.

The power of a single arbitrator to force the sale of a property at the price he dictates will be felt to be very oppressive, though we do not deny that it may tend to promote mining operations while it depreciates the value of vested interests.

The confiscation of mining rights, after two years of idleness, may be a wise measure for future application upon lands yet to be sold, but its enforcement upon lands already ceded without any such proviso is of the nature of such legislation as is advocated by revolutionists. It is probable that an appeal will be made to the Dominion authorities to disallow this measure as a violation of legal rights and an unwarrantable trespass upon vested interests.

The exaction of minutely-detailed quarterly reports from mines, and monthly reports from quartz mills, will prove vexatious. Although some general report is desirable, there seems to be no reason why the Government should have "a description of all shafts, quarries, inclined galleries, working levels, plant, machinery, tramways, railways, openings, open spaces, pushed, made or constructed during the previous quarter." Perhaps the farmer may next be required to report every furrow he ploughs, every crop he sows, and every cow shed he erects. If "that government is the best which governs the least," the present Quebec government, if it is to be judged by this bill, is a very bad one.

On phosphate properties it is customary to make a large number of surface workings. We know of one property on which there are at least 300 pits and trenches over four feet deep, some of which are of great extent. To erect fences four feet high around all these would be a herculean and expensive task. As pits are usually indicated by a rock dump there would seem to be warning enough of their existence.

The list of fines, winding up with $20 for every day of contravention of all other misdemeanors, approaches the ridiculous; but when an offer of half the fine is made to the informer we are compelled to regard the matter seriously as a most demoralizing and vicious measure. Worthless loafers may then earn a living by prowling through the bush in search of pits minus the four foot fence; and for every discovery they may secure $25 as the reward of their sneaking business. The only comfort afforded by this section of the bill is that its lucrative possibilities may entice some of the Quebec legislators into adopting the profession of mining informers, in which case they will perhaps do less harm than by enacting such pernicious laws.

Finally, our objections may be summed up in a query that comes to us from London, "What is the Quebec Government trying to do? Does it want to kill the mining industry?"

Nova Scotia Coal Trade, 1890.

Complete returns of the Nova Scotia Coal trade for the year 1890, have not yet come to hand. Enough, however, is known to allow it to be said that the increase over previous years is satisfactory. The Cape Breton Collieries nearly all increased their output, the Sydney colliery, of the General Mining Association, standing at the head with a total sales of 152,681 tons. Generally speaking there was a want of coal cutters and this was specially felt in the early part of the fall. The mines are preparing for a brisk season's work next year, levels and slopes are being driven in advance, and it is expected that coal will soon be dug and banked out in readiness for the shipping season. The Gardiner Colliery at Bridgeport, which has been closed for about ten years, is being refitted and will be added to the list of producers next season. It is reported that it will be equipped for an average daily output of about 300 tons. The Sydney and Louisburg Coal Company will increase their facilities for cutting and raising coal at their Emery Colliery which was re-opened last year, and by the spring should be able to raise at least 400 tons a day from it. In Pictou County the introduction of the Longwall system at the Vale Colliery will allow an increased output. The work of opening the Albion Main Seam by the Acadia Coal Company is proceeding favourably and will present many new features of interest. Stanley coal heading and coal cutting machinery are being introduced. The coal from this seam yields an admirable coke, and fifty new ovens are being built close to the Foord pit, and so arranged that the waste gases will heat the pump and winding engine boilers. The Intercolonial Company are enlarging their works on the second seam. At Springhill the usual sinking and preliminary work is going on, and generally speaking the mines are in a position to meet any ordinary increase in business.

So far as can be learned the results of the year's work have been fairly satisfactory. The prices that have ruled are not in all cases precisely ascertainable. It is understood that the prices for Cape Breton coals have varied at Montreal from $2.90 to $3.15 a ton, and that at the same point Pictou coals were sold in the vicinity of $3.60. Little Springhill coal is sold in Montreal. The price delivered at Springhill Junction is said to have been $2.50.

It is worthy of note that there is a strong competition at Montreal and Quebec among the coal brokers representing the various mining companies, which tends to lower prices. It is a matter of frequent remark that, if the Cape Breton coal companies were to pool their coal or employ only one seller, they could readily realize 25 cents a ton more on their sales in Quebec and Montreal. This would, beside adding to their profits, allow a slight increase in wages to their employees. In this connection it may be stated that at present enquiries are being made with a view to effecting a combination of the collieries at present operating in Cape Breton. By reducing the expenses of management, offices, haulage, etc., there is no doubt that these companies when amalgamated should yield to both owners and employees far more satisfactory results than have yet been possible.

The operations of the past year have been carried on without any noteworthy accidents. A number of miners have been injured by falls of roof, etc., but in many cases their own negligence has contributed to the accident. The more gaseous mines have been worked with caution, and in many cases the use of powder has been discontinued. The most noteworthy incident connected with the coal trade during the past season was the ten weeks' strike at the Springhill Collieries. This strike was fought with firmness on both sides, but the men gave little cause for uneasiness to those holding property in the town. The ends obtained by the men as conceded by the company were calculated to remove friction in the future, but it is reported that much of the feeling expended on the strike has been directed against the more systematic and economical management that was being inaugurated. The deplorable waste of time and money should prove a warning to the men. They had an excellent Provincial Arbitration Act to which they could have appealed—an Act which very decidedly invited their invocation as its clauses all favored the workmen. In future it is to be hoped that both masters and men will avail themselves of the advantages of arbitration.

There has been a slight increase in the amount of coal shipped to the United States during the past year, principally for gas purposes, owing to a deficiency in the home supplies for that purpose. The suggestion has been made that the Provincial Government should appoint a commission to look into the question if reciprocity in coal would benefit the Nova Scotia coal mines. Numerous references are made to New England manufacturers, etc., who are in favor of reciprocity. These people have everything to gain by reciprocity, as it means cheaper coal to them. But on the other hand it is not yet clear to our miners that they will be able to meet the American shippers who no doubt will meet them with a fierce competition, and at the same time maintain their St. Lawrence trade against the English coal that would come in free of duty as ballast.

The local outlook however, is reassuring. The demand for domestic purposes is steadily increasing, The increase of the bunker and steamer business forms an important item. The Londonderry furnaces are increasing their demand for coal, and the projected iron works in Pictou County seem now fairly launched, so that next summer they should make heavy demands upon the local collieries.

Imports of Coal by Water at the Ports of Montreal, Sorel, Three Rivers and Quebec for the Years 1889 and 1890.

(Authentic figures compiled for THE REVIEW.)

	MONTREAL.		SOREL.		THREE RIVERS.		QUEBEC.		TOTALS.		REMARKS.	
	1889.	1890.	1889.	1890.	1889.	1890.	1889.	1890.	1889.	1890.		
CAPE BRETON COLLIERIES.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.		Tons.
"International"	82,879	89,138	....	1,400	....	....	3,841	2,871	86,720	93,409	Increase over 1889	6,689
General Mining Association	45,297	42,365	8,404	9,000	1,300	10,046	21,828	24,636	76,829	86,047	do 1889	9,219
Sydney & Louisburg Coal & Ry. Co.	48,915	62,798	3,900	14,800	....	....	5,759	8,094	58,574	85,692	do 1889	27,118
"Caledonia"	33,454	70,187	9,910	10,800	3,000	1,690	10,077	3,259	56,441	85,936	do 1889	29,495
"Glace Bay"	33,380	51,000	4,819	3,680	2,240	....	....	1,634	40,439	56,314	do 1889	15,875
"Gowrie"	32,106	45,339	7,372	3,540	....	....	550	4,000	40,028	52,879	do 1889	12,351
"Bridgeport"	....	....	....	....	....	....	....	9,941	....	9,941	do 1889	9,941
	276,031	360,827	34,405	43,220	6,540	11,736	42,055	54,435	359,031	470,218	do 1889	111,187
PICTOU COUNTY COLLIERIES.												
"Intercolonial"	35,452	45,857	9,200	7,100	....	....	....	....	44,652	52,957	do 1889	8,305
"Vale" and "Acadia"	1,213	6,316	....	....	....	....	....	....	1,213	6,316	do 1889	5,103
Total Lower Port Coal by Steamers	312,696	413,000	43,605	50,320	6,540	11,736	42,055	54,435	404,896	529,491	do 1889	124,595
Total importations from Great Britain	....	....	....	....	....	....	....	....	62,629	16,974	Decrease over 1889	45,655
Grand totals	....	....	....	....	....	....	....	....	467,525	546,465	Increase over 1889	78,940

The following statistics of the coal sales have been kindly furnished us by the officers of the companies, and while not wholly complete, will be of interest as showing the output and distribution of the product of the leading producers :—

Pictou County.

Acadia Coal Company :

	Round.	Slack.
To New Brunswick	14,260	2,615
" Newfoundland	......	49
" Nova Scotia	94,550	64,836
" Prince Edward Island	3,863	20,051
" Quebec	22,640	463
" Other countries	......	289
" Bunker steamers	18,945	136
" Colliery employees	4,514	1,646
Total sales 1890, (tons)	158,772	90,085

Intercolonial Coal Mining Company, (Ltd.) :

	Tons.
To Nova Scotia	68,449
" Prince Edward Island	9,036
" New Brunswick	9,634
" Quebec	65,470
" Newfoundland	118
" West Indies	358
" Colliery employees	2,582
" Consumed by engines	7,232
" Consumed by coke ovens	1,491
Total disposals 1890	164,370

East River Coal Co., (Muir & Sons,) :

Total sales 1890	1,360

Black Diamond Coal Company, (Ltd.) :

	Round.	Slack.
To New Brunswick	1,982	30
" Nova Scotia	18,318	10,083
" Quebec	1,888	......
" Colliery employees	276	......
Total disposals 1890	22,464	10,113

Cumberland County.

Cumberland Coal and Railway Company :

	Round.	Slack.
To New Brunswick	89,715	17,332
" Newfoundland	nil	nil
" Nova Scotia	57,341	32,184
" Cape Breton	nil	nil
" Prince Edward Island	nil	nil
" Quebec	157,975	15,302
" West Indies	nil	nil
" United States	......	7,734
" Bunker steamers	......	......
" Colliery employees	6,368	......
Total (tons)	311,399	72,552

Phœnix Coal Co., (Ltd.) :

(Joggins Colliery.)

	Tons.
Total disposals 1890	53,492

Londonderry Iron Co. :

(Chignecto Colliery.)

Total disposals 1890	7,485

Cape Breton.

General Mining Association, (Ltd.), London, Eng. :

	Round.	Slack.
To New Brunswick	5,613	......
" Newfoundland	27,603	22
" Nova Scotia	32,975	33
" Cape Breton	1,328½	3,743
" Prince Edward Island	897	......
" Quebec	68,923	4,732
" West Indies	......	......
" United States	161	786
" Bunker steamers	5,865	......
" Colliery employees	......	......
Total disposals 1890	143,365½	9,316

Glace Bay Mining Co. :

	Round.	Slack.
To New Brunswick	3,253	476
" Newfoundland	8,608	7
" Nova Scotia	14,160	4,047
" Prince Edward Island	806	819
" Quebec	53,969	2,179
" West Indies	3,571	......
" Other countries	12,119	742
" Bunker steamers	3,815	......
" Colliery employees	50	600
Total disposals 1890	100,351	8,870

Low Point Barasois and Lingan Mining Co. :

	Tons.	Tons.
To New Brunswick	10,764	104
" Newfoundland	16,028	92
" Nova Scotia and Cape Breton	21,735	2,715
" Prince Edward Island	1,649	2,150
" Quebec	7,470	1,564
" West Indies	......	......
" United States	......	627
" St. Pierre Miquelon	277	......
" France	180	......
" Bunker steamers	12,014	......
Total sales 1890	70,118	7,252

Sydney & Louisburg Coal and Railway Co., (Ltd.) :

	Round.	Slack.
To New Brunswick	4,466	100
" Newfoundland	4,893	7
" Nova Scotia and Cape Breton	16,300	3,146
" Prince Edward Island	4	172
" Quebec	73,483	14,113
" West Indies	......	......
" Other countries	3,942	......
" Bunker steamers	19,151	......
" Colliery employees	60	3,271
Total sales 1890	122,299	20,809

Gowrie Coal Mining Company :

	Round.	Slack.
To New Brunswick	2,531	75
" Newfoundland	11,065	206
" Nova Scotia and Cape Breton	30,303	6,579
" Prince Edward Island	7,790	2,015
" Quebec	48,700	8,969
" West Indies	404	......
" United States	......	2,869
" Bunker steamers	......	......
" Colliery employees	3,210	2,170
Total sales for 1890	104,003	22,883

Caledonia Coal and Railway Company :

	Round.	Slack.
To New Brunswick	10,634	1,211
" Newfoundland	13,291	1,406
" Nova Scotia	7,419	2,359
" Prince Edward Island	644	4,749
" Quebec	63,710	26,056
" West Indies	384	......
" Other countries	7,698	5,822
" Bunker steamers	(Included above.)	
" Colliery employees	629	972
Total sales 1890	104,409	42,575

The International Coal Co.. (Ltd.)

	Round.	Slack.
Sold in Nova Scotia	3,019	1,878
" New Brunswick	6,753	380
" Newfoundland	1,135	287
" Prince Edward Island.	273	113
" Quebec	56,523	33,062
" St. Pierre Miquelon	132	14
" United States	6,898	766
" Bunker steamers	20,411	1,432
	95,144	37,932

The White's Asbestos Company.

The White's Asbestos Company, to which reference has already been made in these columns, has again been before the public, and, as might be expected from its character, in an unfavorable light. It will be remembered that its prospectus set forth in glowing colors the amount of the mineral already in sight—"the face of the rock displays a network of asbestos veins"—while the annual production was to be at the very least 1400 tons. Subsequent results have by no means justified this promise; the veins are few and scattered, the quality of the worst, and since operations were commenced a poor eight tons alone have been produced, which brought about £20, or not sufficient to pay the expenses of mining and transportation. In view of these facts, the shareholders found the repeated calls upon their stock exceedingly irksome, and one, a Mr. Hoare, refused to pay any more upon what was so evidently worthless. Suit was accordingly brought against him for the amount claimed, and came up for trial a short time ago. The judge found, upon consideration, that the directors had disregarded several "serious and important warnings" that had appeared in several journals, whereas it was their bounden duty to investigate the allegations made against the company's property, and furthermore that material statements in the prospectus were untrue or misrepresented, and judgment was therefore given in favor of defendant, with costs. With this as a precedent, the other shareholders who have not yet responded to their calls will not hesitate to follow suit, and a speedy liquidation appears to be inevitable.

The Geological Map of Nova Scotia.

Being cognizant of the immense importance attached to the geological map of Nova Scotia, by those engaged in mining operations in that Province, a call was made at the offices of the Geological Survey to ascertain what progress was being made in its preparation, and also whether it will be upon the scale generally desired. The whole mining community of Nova Scotia, without exception, have expressed their wish that it shall be upon the scale of one mile to the inch, and representations to this effect have been made both by the Gold Miners' Association and the members of the House from that Province, while the fallacy of the course of the Survey has repeatedly been exposed in these columns. No notice has been taken of these statements, however, as the Director of the Geological Survey, from economical motives, considers that four miles to the inch is ample. During several years, but one report has been published in this region, and that being unaccompanied by maps, was of no practical value to miners though exhaustive surveys have been made in this time, and now that a more extensive treatment of the subject has been entered upon, it will be a serious mistake to thus curtail its usefulness by the reduction of the map to one-sixteenth of the wished-for size, destroying its uniformity with the map of Cape Breton already issued upon the scale of one mile to the inch. Regarding the cost of the work—the great stumbling block—the expenses of the surveys amounted, in round figures, to about $30,000. To produce the maps upon the scale on which they were originally designed, and which is desired, would require a little less than $4,000, but, in order to economise, nearly $1,000 was expended in their reduction to the size proposed by the Department—a sum that would have gone far to make up the difference between the cost of the two maps—so that taking this into consideration, the saving is of no account when compared with the utility of the other. Not only this, but the already culpable neglect shown to this, the most important mining province, has been augmented by the delay entailed in the change. We believe that Dr. Selwyn now desires that the local government of Nova

Scotia should bear part of the expense of the larger map, but this is not within the province of that Legislature, while it is the plain duty of the Survey to publish a map of some economic value, that may be useful to those whom it more immediately concerns, rather than one which, while showing the general configuration of the country, has no utility beyond that point. We understand that strenuous efforts will be made to have this error rectified in the coming session, and the probable ending of the matter will be that the Department will be put to double the expense that would have been incurred had not false notions of economy interfered with the duty owed to the public in general, and an important mining region in particular.

Exports of Canadian Asbestos, 1890.

The following official returns of the shipments of Canadian asbestos have been very kindly furnished by Mr. Frank Grundy, general manager of the Quebec Central Railway. As will be seen, there has been a very substantial increase over the exports of the previous year :—

	Tons.
Coleraine station	158½
Black Lake station	2,518¼
Thetford mines	5,148¼
Or a little over	7,825

The shipments of previous years have been :—

Year.	Quantity	Value.	Year.	Quantity	Value.
1879	300	$19,500	1885	2,440	$142,441
1880	380	24,700	1886	3,458	206,251
1881	540	35,100	1887	4,619	226,976
1882	810	52,650	1888	3,936	277,742
1883	955	68,750	1889	5,588	360,144
1884	1,141	75,097	1890	7,825	....

Silver Exports.

From official returns received we are enabled to give the following statement of the exports of silver ore and bullion from the Port Arthur silver district :—

MONTH.	ORE.	BULLION.
January	$18,050	
February	1,525	
March	100	
April	2,500	
May	10,450	500
June	770	
July	800	
August	56,000	
September	45,190	
October	30,000	
November	35,400	
December	20	500
	$200,805	$1,000

The cost of the recent Australian strikes has been estimated at over one million and a quarter sterling. The loss to labor in the three Colonies of Victoria, New South Wales and South Australia, is reckoned at £909,000, to trade, at £305,000, and to the Governments, in maintenance of military and police, and loss of wharfage and customs dues, at £80,000.

Petroleum in Canada

The production of petroleum in Canada is at present entirely confined to one district, Lambton County, Ontario. Indications of oil have been discovered elsewhere throughout almost the whole of the Dominion, but with one exception, they have not proved of a paying nature, and all operations hitherto commenced have resulted in failure. In Nova Scotia, oil is known to occur, it being frequently seen to rise through the waters of Lake Ainslie, and swamps in the district are often found to be covered, and many springs impregnated with petroleum. Several companies have been formed to test this district, but beyond "indications," nothing has been found. Desultory boring has been done in New Brunswick also, on similar indications and with identical results. At several points in the Province of Quebec, notably in the Gaspé Peninsula, oil is known to exist, and a small amount of exploratory work has been done, and here the prospects are somewhat better than in the two former provinces, but so far no results of any importance have followed. But one attempt has been made to strike oil in Manitoba, by the Manitoba Oil Company on the banks of the Vermilion River, but although boring was carried on to a depth of 743 feet, nothing was obtained, and the effort was finally abandoned as useless. But in the region lying to the north of the territories of Alberta and Saskatchewan, and drained by the Peace and Athabasca rivers, lies an immense oil region, the exploration of which, slight as it has been, has been sufficient to show that it is of great value in this respect, and may be expected at a future time to contribute largely to the output of Canadian petroleum.

As has been observed, however, the production is at present confined to Lambton County, Ontario, where the oil occurs in two distinct "pools" known as the Oil Springs and the Petrolia fields, the former comprising an area of about 2 square miles, and the latter of about 26 square miles. Data are unfortunately wanting to show the production of these pools since their first development, though the output for the past few years has been in the neighborhood of 600,000 barrels per annum. In the earlier years, before the economic operation of the wells was understood, the waste was very great; oil was at one time quoted at ten cents per barrel, and during the spring and summer of 1862, it is estimated that 5,000,000 barrels of petroleum floated off upon the waters of Black Creek.

It is estimated that some 3,500 wells are now being pumped, 2,500 of which are in the Petrolia field, and the remainder on the Oil Springs field. About 400 new wells are annually drilled, to take the place of about the same number that are annually abandoned. The oil from these is run off by pipe lines into the tanks of the various tanking companies, the total capacity of which is about 1,000,000 barrels, certificates being issued to the owners therefor.

Thirteen refineries are in operation, nine of which are located in Petrolia, two in London, one in Sarnia, and one in Hamilton. These employ about 260 men in and about the works, and throughout the oil producing territory there are about 2,000 men employed directly or indirectly, in the production of crude and refined oil.

The exact output of the wells in 1890 cannot at this date be ascertained, but it is estimated at 675,000 barrels of 35 imperial gallons each, as against 639,991 barrels in 1889. The average price per barrel in the latter year was 95½ cents, considerably less than in 1890, as will be seen by the subjoined table, for which we are indebted to Mr. James Kerr, secretary of the Petrolia Oil Exchange :—

MONTH.	HIGHEST PRICE.	LOWEST PRICE.	AVERAGE PRICE.
January	$1.03	$1.01¼	$1.02¼
February	1.11	1.02	1.05⅞
March	1.09½	1.05½	1.07⅜
April	1.10	1.06¼	1.07.7
May	1.08	1.07	1.07.51
June	1.16	1.07¾	1.10.18
July	1.37	1.16	1.23.04
August	1.35½	1.31	1.32.77
September	1.31¾	1.27¾	1.30.45
October	1.32	1.28	1.29.3
November	1.36¼	1.28½	1.32⅜
December	1.35	1.27	1.30.2
Whole year	1.37	1.01¼	1.17⅞

An interesting lecture on "Asbestos," was delivered by Dr. R. W. Ells, before the Ottawa Field Naturalists' Club, on the 17th inst. The lecturer began by tracing the history of asbestos as known to man, from the earliest times, and then proceeded to describe the different varieties, their modes of occurrence and distribution throughout the world, with special reference to the importance of the Canadian field. The remarkable growth of the industry was then commented on, and the uses and manufactures to which it is applied, while the other non-conducting substances which might compete with the mineral were touched upon. With reference to the characteristics of the different qualities of serpentine from which asbestos might be extracted in paying quantities, Dr. Ells, who, it may be remarked, is an unquestionable authority upon the subject, stated that the brown, weather-beaten, siliceous serpentine does not carry asbestos at all; it is rarely found in the soft, slaty, greasy formation of the south, which is very different from the massive serpentine of Thetford and Black Lake. Regarding the age of the formation, he held that the older the richer, and that more asbestos may be looked for in the Cambrian than in later serpentines, an hypothesis borne out by the experience of quartz gold mining. There is a very large asbestos field in the Laurentians of the Ottawa valley and elsewhere, which is only beginning to be known, and in some localities, there is certainly every prospect of finding it in considerable quantities, although, perhaps, not to as great an extent as in the Eastern Townships. We hope to give the full text of this valuable paper in our next month's issue.

En Passant

We notice that at the general meeting of the Canada Company, held in London on the 2nd inst., considerable stress was laid on the discovery of natural gas on their lands. As our readers are doubtless aware, the company owns some quarter of a million acres in Ontario, on which prospecting and mining has been done, particularly in the Township of Loughboro'. The company has not met with as great success in the last few years as formerly, owing to agricultural depression, and any discoveries that will enhance the value of their lands will be appreciated.

An excellent Report on the mineral resources of the Province of Quebec has been compiled under the supervision of the Geological Survey by Dr. R. W. Ells, well and favorably known for his connection with the asbestos industry of that Province, As its title implies, it is a compendium of valuable information regarding phosphates, asbestos, copper, iron, gold, etc., and contains besides the history of all the more important mining enterprises undertaken within the Province, together with a variety of other information obtained from early works upon the subject, not now easily accessible. Its economic geological value is great, and it will be found an exceedingly useful book of reference to all engaged in mining operations.

A deputation from the coal section of the Montreal Board of Trade, consisting of Lieut,-Colonel Henshaw, Messrs. H. A. Budden, R. P. McLea, D. Napier, F. P. Brown and R. T. Routh, accompanied by Mr. J. J. Curran, M.P., recently had an interview with the Minister of Marine and Fisheries, in reference to the recognition of the English Board of Trade certificates of inspection, requesting the exemption of such vessels holding unexpired English certicates when chartered for coal carrying purposes in Canadian waters, as the imposition of inspection dues on this side in addition to the very heavy dues in England, seriously embarrassed the coal and shipping trade, and to no purpose. Hon. Mr. Tupper, replied that the double imposition has only recently been decided in view of a decision of the Department of Justice, but as there was no apparent necessity for it, he would confer with his colleagues with a view to devising a remedy.

Elsewhere will be found, reproduced in full for the first time in Canada, the report to the United States Government of Commander Folger and Lieut. Buckingham, on the nickel and copper deposits of the Sudbury district. Taking it as a whole, it will be a valuable addition to the literature on this subject and will be read with attention by those interested in mineral properties in that region, but it would appear that the writers, throughout the report, have been somewhat biassed in their consideration of the Canadian Copper Company, and have instituted a number of comparisons disparaging to the other companies treated of. We are much mistaken if there be not ranges of nickel and copper in the Sudbury country as rich and extensive as those possessed by the Canadian Copper Company. These points we leave to the consideration of our readers, who will draw their own conclusions on perusal of the report. Otherwise it is of interest as affording a comprehensive idea of the workings in the Sudbury region, and as such will be appreciated at its proper value by holders of lands in that vicinity.

The record of shipbuilding done in the United Kingdom within the past year, shows that the total output was 1,271,110 tons, as compared with 1,300,933 in 1889, and 903,687 tons in 1888. The Clyde, as usual ,heads the list with 349,995 tons, an increase of 14,974 ; the Tyne is next with 235,567 tons, a falling off as compared with 1889, of 46,143 ; the output on the Wear was 197,482 tons, a decrease of 19,854 ; on the Tees, 127,741 tons, an increase of 17,305 ; the Hartlepools 99,847, an increase of 13,792 tons ; at Belfast 66,783 tons, a decrease of 16,220 ; on the Mersey 30,577 tons, a decrease of 5,196 ; at Barrow, 24,665 tons, a decrease of 2,182 ; and at Dundee 24,494 tons, an increase of 6,183. In connection with this, it may be interesting to point out that the output for the whole of Scotland during 1890 was 416,617 tons, as compared 395,841 in the previous year, or an increase of 20,776 tons, and that the tonnage of the north-east ports of England, which reached 695,357 in 1889, had fallen last year to 660,637, a decrease of 35,720 tons. Messrs. Russell of Greenock and Port Glasgow are the largest contributors to the grand total, having launched during the year no less than 70,370 tons of shipping. They are followed in the order given by Sir Wm. Gray & Co. (Ltd.), Hartlepool ; Messrs. Harland & Wolff, Belfast ; and Palmer's Company on the Tyne.

The number of mining companies formed within the past year, sixty-one in all, shows the interest that is awakening in Canada's mineral wealth. From the Atlantic to the Pacific fresh capital has been introduced into the industry, infusing new life into districts previously languishing, and stimulating other sections into increased activity. The greatest number of corporations were instituted in or for the purpose of working mines in Ontario—twenty in all ; Nova Scotia comes next with seventeen, while British Columbia, with fourteen, and Quebec, with seven, have received large additions to the amount of capital invested within their borders. Manitoba and the North-West Territories and New Brunswick, show two and one new companies respectively. The sum represented by these concerns is very large but owing to the fact that some are private ventures, that is, not incorporated, the exact aggregate cannot be ascertained ; and the capital of one English Company, H. H. Vivian & Co., of Swansea, amounting to over $1,500,000, can not be included, both from the fact that only a comparatively small portion of its funds are invested in Canada, and also on the ground that, although incorporated last year, operations had been carried on for some time previously. Even without these, however, the total capital stock of all corporations amounted to $19,637,750—a sum that, whether taken on its own merits or as indicative of what is to come, is extraordinarily large. Of this, British Columbia received the largest share, $6,255,000, Quebec, if the General Phosphate Corporation be included, coming next with $5,334,000 invested. Nova Scotian mines also received a considerable accession of capital, the stock of new companies in that Province aggregating $4,255,000 ; $3,578,750 was put into Ontario enterprises ; $125,000 in Manitoba and the Territories, besides a private concern ; and $100,000 in New Brunswick. From these figures it is evident that the mining industry is rapidly advancing throughout the Dominion, and to a greater degree than is generally known, and as a large influx of outside capital may be looked for, before very long, the present year may be expected to show a still larger sum. A complete list of all companies will be found on another page.

The Excelsior Copper Company, which for two years has been working the well known Harvey Hill mine in Megantic County, Quebec, appears, from the account of the meeting published elsewhere, to have met with no better success than its predecessor. Its chances from the first were very small. To begin with, the capitalization, £450,000, was altogether out of proportion to the value of the mine to be worked, and the real—not prospectus—profits to accrue therefrom ; nor have the subsequent operations borne out the expectations entertained. But it is with the statements and promises of the directorate and management that we have at he moment to do. The chairman apparently entertains the most sanguine belief as to the value of the property, and such expressions as "proved beyond the realm of doubt" are liberally interspersed throughout his remarks. The shareholders hardly seem imbued with the same confidence, however, and the response to the call for £20-000 last April was so small that all subscriptions were returned. It is now proposed to wind up the present concern and reconstruct the company upon the basis of imposing on the shareholders a payment in proportion to their several holdings. Captain Davey, the mine manager, made a most eulogistic speech on the future prospects of the mine—prospects that in the light of past experience are unwarranted, and, it seems to us, that would require something akin to a miracle to fulfil. It is an easy matter to say that at a certain rate of production such and such a profit may be realized, but the prime necessity is to obtain the ore for treatment ; and past workings do not justify the assumption that such can be mined in anything like paying quantities. The former owners of the property operated it upon a careful and economical basis, and yet found it exceedingly unprofitable ; and nothing in Captain Davey's remarks leads one to suppose that any new and rich developments have been made. Of course it is within the bounds of possibility that such a strike may be made; but the fact remains that such has not yet been come upon, nor from the formation of the country is it likely to occur. It would, we think, be exceedingly rash—not to use a stronger term—of the shareholders, in view of their past experience, to sink further money in what has already proved to be more of a chimera than a speculation. Two years' work has hitherto resulted in the mining of only eighty-seven tons, and yet they are asked to further subscribe on the statement and promises of an interested party, who can show no grounds on which to support his far from unbiassed opinion. Such companies are not only disastrous to their own investors, but do incalculable harm to really genuine enterprises, which receive the cold shoulder from English capitalists, who are unable to discriminate between a loudly-trumpeted concern, whose only profits are on paper, and a really honest and remunerative investment.

In a recent issue of one of our American contemporaries reference is made to the fact that notwithstanding that the demand for mica had so increased of late, no corresponding activity was observable in its production within the limits of the Republic. In the construction of dynamos, motors, and other electric appliances, mica plays an important part on account of its flexibility and insulating properties, and with the constantly enlarging sphere of electrical mechanics, a very large quantity is annually used. For these purposes the American article is unsuited, it being found to be inferior in cleavage and flexibility, the two great requisites, and the Canadian "amber mica" is in almost universal use. This is chiefly obtained from the mines of the British Canadian Mica and Mining Co., in the Township of Villeneuve, Ottawa County, Quebec, and of the Sydenham Mica and Mining Co., in the Township of Loughboro', Ontario, although considerable quantities are also taken out by small operators in the Ottawa Valley and Kingston districts. The United States Government, in its recent enactment of the McKinley tariff, has done all in its power to foster the industry by imposing a duty of 35 per cent. upon the foreign product; but even with this assistance very little improvement is noticeable in the output of the American mines, for the reason that, protected or not protected, it is not of sufficient quality and is not therefore wanted; and the only alternatives left to manufacturers of electrical apparatus are either increasing the cost of the machines or using inferior materials; and in this latter connection it is said that some have gone the length of using paper as a substitute for mica. Reference to a recent report of the U. S. Geological Survey discloses some statistics bearing upon the subject. The production of mica in the United States in 1884 was 147,410 pounds; in 1885, 92,000 pounds; in 1886, 40,000 pounds; in 1887, 70,500 pounds; and in 1888, 48,000 pounds. The value of the amount in 1887 was $142,250, and of that in 1888, $70,000. These figures show conclusively that the output is on the whole falling off. Compared with these are the imports of foreign (*i.e.*, Canadian) unmanufactured mica, which for 1884 were $28,284; in 1885, $28,685; in 1886, $56,354; in 1887, $49,085; and in 1888, $57,541. It must, however, be noted that in the imports of the last three years, ground mica waste is included, an article which concerns about 90 per cent. of the product of the mines, and for which there is a steadily increasing demand in the manufacture of lubricants. It is evident, therefore, that left to itself and unhampered by tariff restrictions, the trend of the American demand would be almost entirely towards the Canadian "Muscovite" and amber qualities; and even under the detrimental influence of a 35 per cent. duty, there will no doubt be a large consumption of it within the Republic, while the American mines will derive little or no benefit from a stimulant that may galvanize them into a short artificial life but which can effect no permanent results upon an industry which lacks the essential element of filling a demand. Some one must pay the increased cost of the electrical apparatus or use inferior machines, and that some one is of course the purchaser, while many articles produced by electric power will be dearer, so that it appears as if no one would be benefited, but many injured directly or indirectly, by the mistaken zeal of the Ohio statesman.

The statement of the receipts of coal by water at the four principal ports on the St. Lawrence during the year just closed, given elsewhere in our columns, affords an interesting study at a moment when the question of reciprocity in this particular is being agitated. The arguments used by those who favor this movement are several. It is said that the United States is the true geographical market for Lower Port coal, and that the tariff restrictions which confine the output of Canadian collieries to their own country are vexatious and hamper the industry, whereas, if done away with, the loss of the St. Lawrence market would be more than counterbalanced by the large demand that would arise from the Atlantic ports, etc. Regarding the first, its soundness is only apparent, for it will be readily seen that the American coast market is equally contiguous to the home producing centres from which it is at present supplied, and the competition would be such that the business would not, at all events for a long time to come, amount to very much—a fact that nullifies their second proposition also. This is proved, moreover, by the light of actual experience. In the days of reciprocity there was no great prosperity, but on the contrary the industry languished and made little or no progress, and it was not until 1879, when a duty of 50 cents per ton was imposed by the Dominion Government, that affairs began to look up. Subsequently the tariff was raised to 60 cents, owing to an increase in the imposts in mining plant, etc., and since that time the annual output of Nova Scotia has steadily enlarged until it has reached the present figures. The records of the two periods of reciprocity and protection contrast strongly when placed side by side: In 1869, the total coal sales of Nova Scotia were 511,795 tons, and in 1879, in which a duty was imposed, 688,626 tons; an increase of only 176,831 tons; while in the next ten years we find the sales have increased to 1,555,107 tons, or a gain of 866,481 tons—sufficient and incontrovertible evidence in support of our statement. It is true that the price is still low and profits are comparatively small, but the present condition of affairs is far more satisfactory to owners and employees than the old condition of things. And it is to Quebec that this is due almost entirely. Ontario is too far west for the Nova Scotian collieries to compete with American coal, even under the present duty, but the sister province has since 1879 turned altogether to the Lower Provinces for fuel, and has absorbed vast and ever-increasing quantities. In 1879, the shipments to Quebec amounted in all to only 83,710 tons; in 1889 the imports by water at the four principal St. Lawrence ports of Nova Scotian coal were 404,896 tons; and last year, owing to somewhat lower freights and a better demand, the aggregate had increased to 529,491 tons—124,595 tons more than in the preceding year. From this it may be judged that the industry is in a healthy state, and that the future shows a promise, for the loss of which no American demand that Nova Scotia could secure could compensate. Two further features in the statement of favorable character also attract attention. It will be observed that not only was the aggregate exportation greater but that every colliery participated in the gain, the relative business of each for 1889 and 1890 showing a satisfactory balance, in some instances amounting to many thousands of tons, in favor of the latter year. And also the imports of coal from Great Britain had largely decreased and formed but an inconsiderable item in the gross total, for while in 1889 62,629 tons were brought to the Province of Quebec, only 16,974 were imported last year, showing that the Nova Scotia article is growing in favor as well as in demand. From these considerations, it is plain that the collieries in the Lower Provinces have much to lose and nothing to gain by any change from the present state, and on the subject of reciprocity a "masterly inactivity" will be found the most profitable attitude in the end.

The case of Dansereau *et al* v. the Dominion Phosphate and Mining Company, limited, was resumed on the 15th instant, in the Supreme Court at Aylmer, Mr. Justice Malhiot presiding. Mr. J. M. McDougall appeared for the plaintiffs, and Mr. J. R. Fleming, Q.C., for the defendants. It was commenced in May, 1890, but owing to the difficulty in collecting witnesses, and the absence at one time and another of the principals, it was adjourned until the above date. The history of the suit is as follows: In 1883 the phosphate mine owned by plaintiffs on what is known as the Chapleau lot, situate in the Township of Portland East, Ottawa County, Province of Quebec, was closed down, the mining plant being left on the property. Adjoining this property is the North Star mine, operated by the Dominion Phosphate and Mining Company, the defendants in the present action, and it is claimed that the latter appropriated the plant belonging to plaintiffs for the purpose of developing their own mine. Dansereau *et al.* are now taking action to recover the value of the following effects, alleged to have been taken from their property: one steam boiler, one Ingersoll steam drill, with pipes, steels, fitting, etc., one pipe cutter, vise and tongs, three one inch globe check valves, two-¾ inch ditto, two dumping cars, a lot of crowbars, hammers, hand drills, etc., one complete set of blacksmith's tools, comprising sledges, bellows, files, anvils, pincers, etc., six iron pulleys, three shears, wire rope, derrick irons, three mining buckets, one hand force pump, between 600 and 1,000 feet of rope, and sundry minor articles, the whole of the value of $2,176. The defendants while admitting the taking of the above articles, answer that a number were returned. To this the plaintiffs respond that, if such be the case all articles returned were in a condition unfit for further use, and that their claim for the whole amount should lie. The case is likely to continue for some days. A number of witnesses have been examined on the plaintiffs' side, among others, Messrs. G. R. Smith, E. G. Horan and F. S. Higginson, giving corroborative testimony as to the value of the plant.

The Annotated List of Canadian Minerals, by Prof. G. C. Hoffman, which has appeared in recent issues of the REVIEW, has attracted much attention as a concise and handy reference for the mineral community. In it will be found the chief localities of occurrence of each mineral, though it should be noted that Prof. Hoffman disclaims the enumeration of all the territories in which these minerals are found. The value of the work has been recognized by the Government who have had it issued in pamphlet form under the direction of the Geological Survey.

During 1890, 6,221,518 tons of coke were marketed from Connellsville, Pa., as compared with 5,325,826 tons in the preceding year. The prices obtained in 1890 were also considerably better than in 1889, coke selling for the first two months at $1.75 per ton, and for the remainder of the year at $2.15, the total value of the sales being $12,903,940. In 1889, the price varied from $1 to $1.75 per ton, the average being about $1.40, and the aggregate value $8,156,156. Oven building has been active during the year, over 1,600 new ovens having been erected and a large number re-built. In 1889 the number was 14,458, while including those approaching completion, the total ovenage for 1890 was 16,113. The shipments for 1890 show a grand total of 355,070 cars, an average of 1,147 cars for every working day in the year, nearly 100 cars better than in 1889.

The price of coke, which had been firmly maintained at $2.15 during the last ten months of the year, has been reduced 25 cents per ton for the present, owing to the importunities of the furnace men and the depressed condition of the iron trade, but the understanding is that it will shortly be advanced again to at least $2.

Regarding reciprocity in coal, which is elsewhere referred to, several strong arguments against it are brought forward by Mr. J. R. Lithgow, secretary of the Glace Bay Mining Company, Halifax, in a letter from which we take a few extracts. He says:

> "I have received a letter from one of the best informed coal brokers in New York, and during the reciprocity treaty which ended in 1866, the largest importers in the United States of Nova Scotian coals, wherein they say: 'We do not think the market for Nova Scotian coals in the United States, would be materially increased by the removal of the present duty of 75 cents per ton. The sharp competition which exists between the different producers of the domestic coal, and the rapid growth of the facilities for supplying them, will, we think, keep the price of our domestic coals as low, if not lower, than Nova Scotian coals could be delivered in the States free of duty.'
>
> "Not only would American coal, if free of duty, supplant Nova Scotian to a considerable extent in the province of Quebec, it would also create such a competition that the delivery prices in that province would be so lowered as to leave little if any profit to the shippers. Even with 60 cents per ton duty, delivery prices have been too low; remove the duty and of necessity still lower prices would follow and some of our collieries would have to shut down.
>
> "In the United States their own coals are so much preferred to Cape Breton, being freer of sulphur and soot, that they are preferred at 25 to 50 cents per ton more; hence this must be borne in mind in estimating the probable net value of Cape Breton coal in the United States. Now, last year $2.15 to $2.25 was the f.o.b. price at Baltimore of the best steam coal, and the freight to Boston was 90 cents to $1.15 exclusive of the cost of discharging on to the wharf of purchaser. And this, be it remembered, when foreign competition was shut out by the 75 cents duty. American consumers are said to be crying out for the removal of the duty and cheaper coal; suppose the duty were removed and the way prepared for the admission of Cape Breton coal, would not the price of American coal be lowered at least 25 cents per ton? If so, then $3 would be about the cost of a ton of American steam coal delivered at Boston; deduct from that 50 cents and you have about the value of a ton of Cape Breton coal delivered alongside of wharf in Boston. Well, when it comes to that, I hardly know whom to pity most, those who ship the coal or those who freight it."

We recommend these paragraphs to the consideration of those who are agitating for reciprocity.

Some light is thrown on the impressions created in the minds of European investors by the proposed mining tax of three per cent. to be imposed by the Quebec Government, in the following extracts from a letter from Dr. C. Killing, of Amsterdam:

> "I have been sent out by a large financial syndicate from Europe to Canada for the purpose of examining whether conditions are favorable to the investment of capital in Canadian phosphate mines or not. I have made a careful study of the question and my impressions on the whole are not unfavorable. But I may say the story of the proposed Government tax of three per cent. upon the output is a great disappointment.
>
> "Suppose for instance that the European capitalists I represent should invest $50,000 in the purchase of a mine or phosphate lands, and the yearly output of the property was 5,000 tons; the governmental tax would in that case amount to between $2,500 and $3,000, or between 5 and 6 per cent. of the invested capital. Do you believe that foreign capital will be attracted to a country where, besides other taxes, 6 per cent. must be paid to the Government? I believe that not one dollar of such capital will come into the country if this tax is imposed.
>
> "I am now going back to Europe to report on the conditions of the investment of capital in Canadian phosphate mines, but I am sure that my friends will not think further of putting money into an enterprise under these circumstances.
>
> "Everybody in the country knows that phosphate mines with a small output lose money, and that only those which produce large quantities make any. It would be an unjustifiable wrong to impose a tax upon phosphate mined at a loss. This experiment is very dangerous as well for the future of the phosphate mines as for mines in general, because I believe the industry cannot progress without foreign capital, but must remain in its present crude state.
>
> "The principle of the tax is not wrong; it is its application. If the Government were to place an impost of three per cent. upon all outputs in excess of 4,000 or 4,500 tons, the small miners, who are barely paying expenses, would be protected, while the Government would derive more revenue from the paying properties."

We hope to have our old cover ready from the paper maker in time for the next issue, that in the present number being purely temporary.

The change of title in this issue from the Canadian Mining Review to THE CANADIAN MINING AND MECHANICAL REVIEW will not bring about any material alteration in the matter contained therein, being merely in order to assimilate more closely some interests connected with the mining and quarrying industries.

Representations were made a few days ago to the Montreal Board of Harbor Commissioners by a deputation from the Coal Agents' Association, that the existing charge of seven and a half cents per ton of 2,000 pounds for coal wharfage was too high, in view of the large and increasing trade between the Maritime Provinces and Quebec. The Board undertook to fully consider the arguments advanced and the deputation then withdrew.

The annual report on the work done by the Geological Survey of Canada in 1890, is daily expected, though it has not yet left the printers' hands. Sufficient time has elapsed to allow of its publication, and we hope, therefore, to be able to refer to it at greater length next month. The full report on the Sudbury district by Dr. Robert Bell is expected to appear some time in March. An interesting feature will be a number of photographic views of that region.

Mr. James Cooper, president of the Ingersoll Rock Drill Company, has gone to England to further negotiations for the transfer of some mining properties in which he has an interest. Mr. Geo. R. Smith, for many years superintendent of one of our phosphate mines, and more recently extensively engaged in the mining machinery and supplies business, has also gone to England in company with Mr. Cooper. Both gentlemen are widely known and highly respected, and we are sure that good wishes will follow them from their numerous friends.

A Novel Application of Electricity to Mining.—A recent addition to the application of electricity to mining, and one which seems destined to find considerable use, is a portable device for detecting the presence and nature of a mineral where the latter is exposed in the rock or earth. This apparatus, which is intended for the use of prospectors more particularly, consists of a battery and spark coil, which are enclosed in a box, and the conductors end in two platinum points. It is evident that if these points be connected to a conducting body and the circuit ruptured, a spark will be formed, the flame and color of which will give some indication of the nature of the body which the electrodes have touched. Thus, by placing the two points against a rock containing metal in a free state, its presence may be detected by merely applying one electrode and passing the other rapidly over the surface. The machine, which was invented by Mr. F. H. Brown of Chicago, will, it is said, enable a novice or "tenderfoot" to pick up float rocks on the hills and tell instantly whether they contain mineral or not, and even the comparative quantity in a rough way. By means of this instrument, also, it is possible to find a lost "lead" in a shaft or cut by applying it to the walls. Another use to which it may be put is to the sorting of ores, the color of the flame enabling the sorter to separate the different kinds. The apparatus, which weighs about ten pounds, is arranged to be carried on the back, and can be used to explode blasts in connection with electric primers.—*Electric Engineer.*

Brown's Patent Steel Wire Chain.—The Greening Wire Co. of Hamilton have just made a very important addition to their already extensive lines of manufacture, having purchased the sole right for the manufacture in the Dominion of Brown's Patent Steel Wire Chain. They claim for this chain, that being made of hard drawn steel wire, and the links being formed without welding, a uniformity of strength is obtained that is not possible in the ordinary chain. Actual tests show a wonderful difference between the Brown chain and the welded, a test made of No. 8 wire, broke at 1,950 lbs., breaking at the end of the link, while the same size of welded chain broke at 490 lbs.

Sudbury Nickel Deposits.

Report by Experts to the United States Government.

Bureau of Ordnance,
Navy Department,
October 14th, 1890.

Hon. B. F. Tracy,
Secretary of the Navy, Washington, D.C.

Sir,—In obedience to the Department's order of the 28th ultimo, we proceeded to Cleveland, Ohio, and on the afternoon of the 1st inst. were received by the Board of Directors of the Canadian Copper Company. These gentlemen informed us that every facility would be afforded us to see their property in Canada, and the plant, progress and processes at their mines.

Mr. S. J. Ritchie, one of the directors, was selected by the Board to accompany us, and he subsequently instructed the manager of the works to freely answer all our questions concerning the mines, and the operations of the company, at the various points under his management, and during our visit we found every indication of the desire on the part of the management and its employés to show us the exact state of affairs.

Wednesday night we left Cleveland; arrived at Sudbury Friday afternoon in time to examine the mining operations at the Copper Cliff Mine. Saturday we visited the roasting beds, and the smelting works at Copper Cliff, and were shown the indications of the line of ore deposits extending from the Evans to the McConnell mines.

The same evening we went to White Fish station, on the Algoma branch of the Canadian Pacific Railway, and the next day visited the deposits of the Crean Hill range and the Vermillion mine, returning to Copper Cliff to spend the night.

Monday we went to the Naughton station on the same line, and from there rode to and saw the Company's property in Creighton Township. Tuesday we visited the Stobie mine, and the works of the Dominion Co., at the quarter section marked Du Charme on the map (enclosure No. 1), Sir Hussey Vivian's works at the Murray mine, and the Worthington mine, belonging to the Dominion Company, at the point called Crean mine on the map above referred to.

The next morning we started on our return, via Sault Ste. Marie, visiting on the 10th inst. the shops of the Gates Iron Works and Fraser & Chalmers, manufacturers of mining machinery at Chicago, thence to Cleveland, Ohio, where we were again present at a meeting of the Board of Directors of the Canadian Copper Company, and on the 12th inst. returned to our regular stations.

Having thus briefly summarized our itinerary, we have the honor to submit the following general observations upon the mining district of Sudbury, and a more detailed description of the special points we visited:

THE SUDBURY MINING DISTRICT.

The presence of extensive and promising tracts of mineral deposits in what is now called the Province of Ontario has long been known, and as early as 1846 a report was made to the Canadian Government stating this fact, but saying that owing to the difficulties of access and the cost of transportation, working these deposits must be delayed until railways were constructed, and freightage to markets thereby reduced.

Enclosure No. 2.—A map published by the Canadian Pacific Railway Company shows the situation of this district and the lines of railways now finished; and it was not until the construction of this railroad that the great value of these deposits were even moderately estimated. Mr. S. J. Ritchie took out applications covering a territory of about 100,000 acres, extending in a north-easterly direction from Crean mine to Stobie, and embracing a belt of territory about 25 miles long and from three to seven miles broad, within which the mineral deposits were reported to lie. Upon a more careful examination of this district he selected the territory shaded red from the Evans to the Stobie mine, suffering the remainder which he had pre-empted to revert to the State. The Canadian Copper Company, which had been chartered January 6th, 1886 (capital $2,000,000, afterwards, August 8th, 1889, increased to $2,500,000) under the laws of the State of Ohio, and granted by special act of the Canadian Government, all the rights that it would have acquired under a Canadian charter, subsequently purchased the tract of land colored red in Creighton. All of the beds of ore seem to lie between strata of granite on one side, and diorite on the other, and as those formations generally plainly appear on the surface, they have guided the company in its selection of territory. We were fully convinced from the surface indications and the borings and shafts already sunk, that the company have an amount of mineral which cannot be exhausted by this generation. The surface indications are found in the belt previously mentioned, and although they seem in each case bounded by the walls of granite and diorite, more careful examination of the country when it is opened out may discover other valuable deposits, connecting those owned by this company.

The general character of this country and the neighborhood for hundreds of miles is broken by rocky ranges, from 100 to 600 feet high, the bare rocks cropping out in many places and the rest covered by a thin soil, upon which were pine forests. Between the hills are marshy valleys, and numerous lakes and streams, capable of furnishing abundant water power. As yet there are no roads, excepting in the immediate vicinity of the railways, and the country is accessible only on foot, except where trails have been cut to several points.

About eighteen years ago forest fires swept the whole neighborhood, and the standing trunks of immense pines are surrounded by a second growth, which in the valleys is so dense as to be scarcely passable, and, with the fallen trees, slippery rocks and marshy lands, renders even a prospector's task difficult.

The Canadian Copper Company claim to have spent thousands of dollars in surveying and prospecting, and as they had the right of selection, it is reasonable to suppose that, with the great capital at their disposal, they did not leave much to others. The properties of the other companies mentioned are at the extremities of the belt, and may be only the fringe of the main body of deposits. From our examination they appeared to be in extent and capability hardly one per cent. of that owned by the Canadian Copper Company.

The Crean mine, at the south-west extremity, has been worked out and abandoned, and the Worthington mine, near the same, seems to be only a pocket.

The Dominion Company's mine, at the other extremity, seems to be nearly worked out, and the Murray mine but comparatively small; should other deposits be not found outside the belt mentioned, the Canadian Copper Company have practically everything. The others claim, however, to own large tracts of land in the north and north-west, but the existence of ores therein is disputed, and seems to be doubtful. Neither company claims to be doing any work beyond prospecting, at any points we did not visit.

The character of the ores in this district is technically described in a paper written by Dr. E. D. Peters, who was for a time manager of the Canadian Copper Company.

It is important to notice from an economic point of view, that these ores can be smelted in their natural state, that is, they do not require the admixture of fluxing substances. The dead pine timber found in great abundance in the neighborhood, and which can be delivered at the furnaces at $1.80 per cord, is a good fuel for roasting, though hard wood would be better, but owing to the fusible qualities of the ores, and intermixed rock, it answers the purpose. Coke is hence the only material that has to be brought from abroad. This is procured from Pittsburgh, and can be delivered at the works at $7 per ton.

The general processes are:

1st, Mining.
2nd, Roasting.
3rd, Smelting.

The points selected for mining are determined from surface indications, and by examination of the substrata by a diamond drill. This drill cuts a core from the rock through which it passes, thus furnishing material for analyses of the substrata. The convenience of working and transportation are of course considered. Should the deposits of ore be in large quantities on a hillside, it is simply blasted off, but as they more frequently dip under the surface, mining by a series of levels is less expensive. A shaft is run at an angle determined by boring a convenient depth, and then the ore blasted out of a large chamber, the miners working around the walls and ceilings, standing on the mass already thrown down, until work on this level is exhausted. The shaft in the meantime is continued to another level, and another chamber worked as before. Shaft mining is also much better adapted to the severe winter climate than surface work, and is alone sufficient reason for its adoption here.

The mass of rock and ore thrown down in the chambers is broken into handling sizes by the miners, the good ore separated from the rock and low grades, loaded into trucks and hoisted to the crusher at the top of the shaft. Passing through this, it is divided by sieves into three sizes, and falls into bins respectively. Before and after crushing, the "gangue" (non-ore bearing rock) is picked out as much as possible.

The rock from the chambers and low grade ore are dumped into a heap at one side.

2nd, Roasting.—Roast beds are prepared by levelling a surface on the ground, which should be well drained and hard. Upon this a thin layer of the "fines" is laid, then a layer of pine wood from one and one-half to two feet in thickness, according to the fusibility of the ores; then "coarse" and "ragging" is laid on to a depth of about seven feet, and the whole covered over with "fines" to confine the heat. Fires are started, and the mass burns from 40 to 70 days. It is then broken up and transported into bins near the smelting furnaces.

3rd, Smelting.—The furnaces are, speaking generally, vertical receptacles, into which combustion, started at the bottom, is continued through successive layers of coke and ore, the minerals fusing and running off as matte at the bottom, and the feeding continuing at the top as the mass smelts down.

Various qualities of ores are in bins at the level of the charge door of the furnace, and the successive charges of ores and coke are weighed and shovelled into the same. A cold blast at the bottom stimulates the combustion, and as the mass is fused it runs into a forehearth, from which the slag is drawn off at short intervals through a taphole near the top, and the matte at longer intervals from the bottom.

Upon the disposition of the means of handling the material through its various stages, avoiding handling to the greatest possible extent, depends to a considerable degree economic production.

Having thus generally noticed the characteristics of the district, and the processes employed, we beg leave to give a detailed description of the mines and ore deposits, as follows:

THE CANADIAN COPPER COMPANY.

The Copper Cliff mine and vicinity.
The Evans mine and vicinity.
The Stobie mine and vicinity.
The deposits in Creighton Township.

THE DOMINION MINERAL COMPANY.

The Blezard mine.
The Worthington mine.
The Crean mine.
The Murray mine.

The Copper Cliff mine is situated on a branch road, about a mile from Copper Cliff Station, about four miles from Sudbury, on the Algoma branch of the Canadian Pacific Railroad. and was opened in the summer of 1886. The face of the hill, about 60 feet high, was blasted off, and a shaft sunk at 45° into the earth. The mining is now on the fifth level, and the sixth about to be opened, the length of the shaft being about 600 feet. 56,534 tons of ore have been taken to the roast yard from this mine from the opening up to the 1st of October, 1890. At present about 180 tons of ore are crushed daily. There are no indications of decrease in the extent or richness of the ore. It does not appear in veins, but the entire mass seems ore of varying grades, with small quantities of rock intermixed. There is irregularity in the ore as to the proportions of the above named minerals, one or the other predominating in spots in a way not to be predicted or accounted for.

The average amount of copper and nickel combined is about eight per cent., five of copper and three of nickel. Specimens, however, have been picked with copper running as high as 30, and nickel 15 per cent., but the presence of small deposits of abnormal richness cannot be considered as indicative of the richness of the mine, as regularity promises greater extent of the deposit.

The plant consists of a hoisting engine, with two drums and cables, one No. 5 Blake crusher, 15" × 9" aperture, with sieves for sorting ore, capable of crushing about 400 tons of the kind of ore taken from this mine in 24 hours, a steam pump and reservoir for compressing air for the rock drills, a small machine shop for making repairs, two boilers, furnishing about 80 H.P., which suffices to run all of the machinery, one steam pump used at the lower level of the mine, which condenses into the tank it pumps from, one small pump run by compressed air for filling this tank, and four rock drills, also run by air. In addition are the ore trucks and utensils for blasting, breaking and handling the ore.

Near this mine are the offices of the company, and about 40 log houses for the employés and their families.

The ore from the bins under the crusher drops into dumping cars upon the railroad track, which connects with the roast yard. This track runs up grade on to a trestlework about a mile long, leading towards the smelting furnaces. On one side of this trestle, the level of which is about 15 feet higher, the ground is levelled off for the roast beds, about 2,000 feet along the track, and from 150 to 75 feet wide. The ore from the cars falls through a chute in hand barrows, by which it is distributed over the beds. After roasting, the ore is carried in hand barrows to a track running parallel to the other, on the opposite side of the trestle, and on the level of the roast beds. This track leads to the smelting furnaces, and the roasted ore is dumped into the bins thereat. The present capacity of the roast yards is about 60,000 tons. This can be easily increased to 90,000 by preparing the ground near it at small expense, and indefinitely by lengthening the trestle, and cutting into the hillsides at no great expense.

At the time of our visit about 35,000 tons of raw ore were in the roast yards. The work in the yards is done by contract, and at present about 75 men are employed. The company provides fuel, plant and tools, and the contract price is 20c. per ton from bins and off cars on to the beds; and 30c. per ton off beds into cars, and into bins at smelting furnace. Total from bins at the mine to bins at the furnace, 50c. per ton.

Working full power, the beds can be used about four times a year; that is, counting the time occupied in bedding, roasting, and clearing the beds, it can hardly average less than three months; the full yearly capacity of the present yards is 240,000 tons. By additions that could be made in one month, the yearly capacity could be increased to 360,000 tons.

All the roasting of the Canadian Copper Company will be done at this point.

In connection with the line of tracks from the main line and roast yards are the smelting furnaces. The plant here consists of two Herreshoff water jacketted furnaces, with two complete sets of blowers, either of which has sufficient power to supply the blast for both furnaces.

The two levels of track are conveniently disposed for economical handling, the upper level dumping into the bins, on the level of the feeding platform, the roasted ores, raw, "fines," and coke, and the lower taking away the "matte," loaded from where it lies level with the platform of the cars.

The Herreshoff furnaces are an American patent, and said to be the best used. One has reduced 187 tons of the ore from these mines in one day, and the manager and furnace man said that, running without forcing, 135 tons could easily be reduced. English furnaces of the same size do not reduce more than 50 tons per diem.

The manager and chemist at the works said the average of the last month production was that about six tons of ore produced one ton of matte. The directors say that the records of the office show that, since the smelting works were started, about five tons of ore produced one of matte.

The ores from the three bins are smelted here, the company having no other furnaces, and they are combined so as to smelt readily. About one ton of coke is used for every ton of matte run off.

At the time of our visit only one furnace was running; the other was repairing. The average daily production of matte for the last month was 25 tons.

The full capacity of the two furnaces per diem would be about 60 tons of matte. The matte averages 17 per cent. nickel and 23 copper.

The daily output of nickel would be, at this rate, 10.2 tons.

There is at present about 6,500 tons of matte ready for delivery, and the ore on the roast beds will produce about 6,000 tons more, containing 1,105 and 1,020 tons of nickel respectively.

To run one furnace the following men are required:

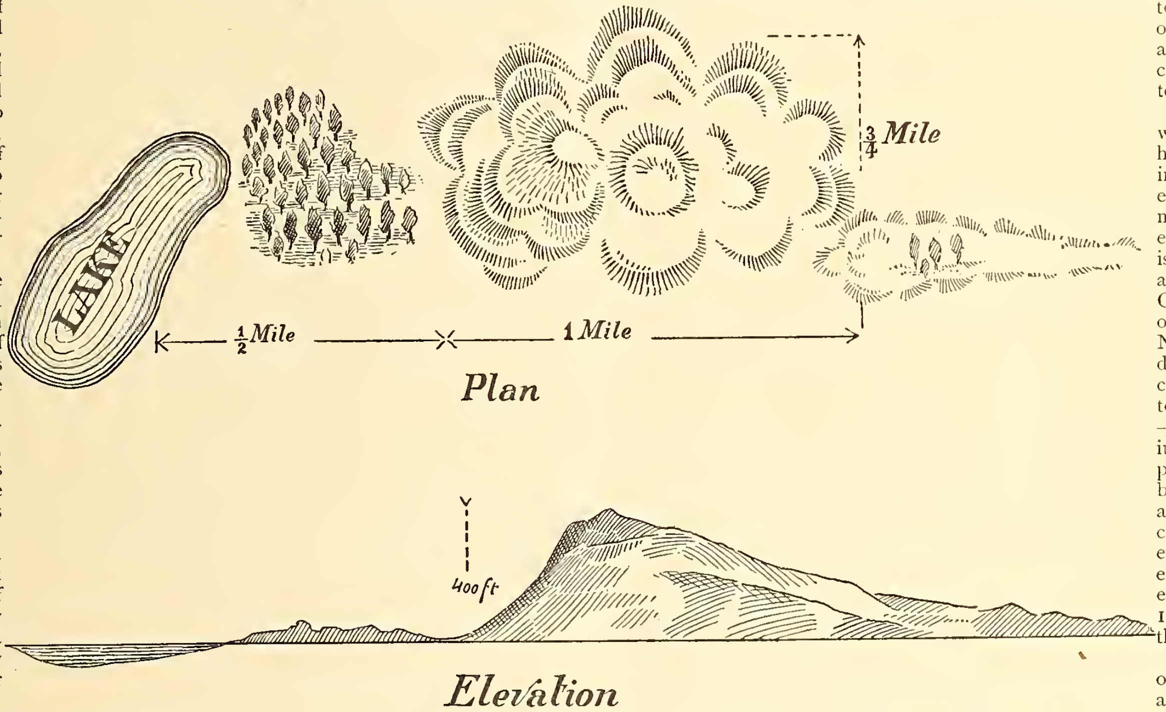
One weigher.
Two engineers.
Two furnacemen.
Two slag-wheelers.
Two charges.
One yardman.

Total, ten men, at an average pay of $1.80 per diem.

Attached to the furnaces is a well fitted laboratory with F. L. Sperry, chemist, in charge, and two assistants. Here each run of matte is analysed, and assays made of ores as needed.

The whole disposition of the plant is well planned for working with economy, and it will be observed that the ores are handled but four times: 1st, into the cars in the mines; 2nd, into the crusher; 3rd, off the roast beds; 4th, into the furnace. At other operations it falls by gravity into or from the bins or cars.

To increase the plant the company has purchased a "Gates Crusher" from the Gates Iron Works of Chicago, and it, with its accessories, is now on the grounds ready to be set up. It is the largest size they make, with three apertures, 18" × 42" each, and its capacity is listed in the catalogue of the makers 100 to 150 tons per hour. Gates, whom we saw in Chicago, stated that it would crush 200 tons of the friable ores of Sudbury per hour. This will give a per diem crushing capacity at the Canadian Copper Company's of 6,000 tons.



THE VICINITY OF THE COPPER CLIFF MINE.

Starting from the hill into which the shaft of this mine is sunk, we rode over a range of hills to the point named on the map "McConnell mine," a distance along the range of about 2½ miles. On the hill just back of the shaft of the Copper Cliff mine borings have been made, all finding good ore. One was sunk to a depth of 291 feet at 15° from perpendicular, and the core extracted showed good ore for 226 feet along this length. Following along the ridge, which we estimated was from 100 to 250 feet above the level of the valley at Copper Cliff, and from 300 to 1,000 feet broad at base, the surface indications are continuous. At the Lady Macdonald mine and the McConnell mine the hills of ore were most conspicuous, and at places of each the surface had been blasted away to a depth of several feet, where rich ore, unaffected by exposure, was found. The surface indications are so evident that no expert knowledge is needed to pick out the ore-bearing rock, which is reddish brown, and quite friable, very different from the granite and diorite range which bound it. The assays of both the above mines show rich ore, better than at Copper Cliff, and in the case of the Lady Macdonald, blasting at the top of the hill and about 150 feet lower, at the small lake, finds good ore, leading the prospectors to assert that the hill was a rich mass throughout.

From this range to Stobie mine, the land is lower, and the country hardly passable. We were told that surface indications at various points connected these with the range of Stobie deposits three miles to the north east. We did not attempt to ride through this country.

Specimens from the various points blasted out were procured on the spots, and can be analysed if the department so directs.

The Evans mine is situated about 1½ miles south west of Copper Cliff station, near the Algoma branch of the C.P.R., and is connected therewith by a half mile of track. It was opened in the summer of 1886, but work was not pressed, and in 1887 only a depth of 20 feet was reached. Now the shaft runs down to the second level of 186 feet from the collar of the shaft. The first level has been blasted to the surface, and a large pit about 90 feet deep and 200 feet in diameter is exposed. The sides appear to be for the greater part, ore, and no limit has yet been reached.

The mining plant here is practically the same as at the Copper Cliff. The hoisting machinery, however, is somewhat heavier, and the steam power is provided by a battery of four boilers, capacity, 220 H.P., of which two are sufficient to run the plant. The crusher capacity is the same as at Copper Cliff, about 400 tons maximum per day. 32,817 tons of ore have been taken from this mine to roast previous to October 1st, 1890. At present about 180 tons are crushed daily.

The grade of the ore is not quite as high as at Copper Cliff, and averages about seven per cent. Some roasting has been done here, but in future all the ores will be taken to the main roast yards. A short line, about half a mile, connects with the main line, and facilities for handling ore are the same as at Copper Cliff.

THE VICINITY OF THE EVANS MINE.

A granite range between the hill now worked at Kelley Lake seems to bound the deposits in a south-easterly direction. The company owns the lots which are shaded by etching in addition to those colored red on the map. Surface indications are found to the north connecting with the Copper Cliff Range, and the hill halfway between has promising deposits; thence across the valley to Copper Cliff are no surface indications, nor have any borings been made, but it is thought that the bed of ore connecting the two may be found at a moderate depth.

The Stobie mine is situated about 3½ miles north of Sudbury, near a branch of the C.P.R., built to serve this and the Blezard mine, and connected therewith by a quarter of a mile of track. It was opened during the summer of 1887, by running two tunnels horizontally 100 feet into the hillside, about 150 feet apart, both of which developed excellent ore. Since then mining has been carried on by simply blasting off the face of the hill to about 50 feet depth, and 300 feet across the face. No limit to the deposit has yet been reached. 15,690 tons of ore have been carried from this mine to the roast yard up to October 1st, 1890, and the daily average at present is about 110 tons.

The mining plant is about the same as at the Evans mine; one Blake No. 5 crusher, drilling and hoisting machinery.

The blasted rock is broken up in the pit, loaded by hand into buckets, which are dumped into trucks, hoisted up an incline to the crusher, and thence passing to the bins.

The percentage of nickel and copper at this mine is smaller than at either of the others, hardly averaging above five per cent., but several pockets very rich in nickel have been worked.

The ore is remarkable for its fluxing qualities, and forms a valuable mixture to smelt the less fusible ore of the other mines, and entirely obviates the necessity of the addition of any foreign fluxing substances.

The crushed ore is carried on cars to the roast yard as Copper Cliff.

THE VICINITY OF THE STOBIE MINE.

Stobie is, in the opinion of the Canadian Copper Company, the north-west limit of the valuable belt of ore deposits. Passing over the hill now worked, which is about 90 feet high, and about 600 feet at the base, and seems almost entirely a mass of ore, and over a valley, a ridge is found extending to the south-west in the direction of the Lady Macdonald mine. The range is almost bare of timber, and the deposits could be easily seen. We were told the length of the ridge was two miles, but we did not take time to go over the whole of it. The height is estimated from 50 to 150 feet above the level of the railroad at Stobie, and from 300 to 1,000 feet across the base of the mounds forming the ridge.

THE DEPOSITS IN CREIGHTON TOWNSHIP.

These we reached from the railway above Naughton station by a ride of five miles through an almost inaccessible country. The size of the deposit is far more striking than any we visited. It is a mound of the general dimensions shown in this sketch, the dimensions of which are estimated. The height of the mound is taken from the level of a body of water as indicated on the map. The hill, over the greater part of which we rode, seems to be entirely ore-bearing rock. No assays have been made of the ore of this deposit, and we can only say that the indications of an immense deposit were more striking here than at any other point. This property was acquired by the company in 1886 and 1887.

THE DOMINION MINERAL COMPANY.

The Blezard mine.—This, the principal mine of the company, is situated on a branch built by the C.P.R., and owned by it, in the quarter section marked "Du Charme" on the map, and colored yellow. It is about 4½ miles north of Sudbury, and it is the northern extreme of the deposits now worked or known to us to exist. Three shafts are sunk into the hill vertically, about a hundred feet apart. The main one is sunk about 90 feet, and chambers worked from this level. They extend for about 200 feet in each direction, and the manager said that since July 15th, 1889, 45,000 tons of the ore had been taken out. The rumours in the neighborhood are that the mine had been worked out, but they were from competitive sources. The chambers seem well cleaned from ore, and though lighted by electricity, we could see but few evidences of active mining. The manager claimed a daily product of 180 tons of ore; that it took from nine to twelve to make one ton of matte, and that this averaged from 20 to 30 per cent. nickel, and from 12 to 15 per cent. copper.

The hill which was being worked was about 100 feet high, and about 500 feet in diameter. We saw no evidences of other deposits near, and the manager claimed none. The plant is excellent, and copied after that of the Copper Cliff mine in the selection of machinery. One Blake No. 5 crusher, and rock drilling and pumping machinery, of the same pattern as before mentioned—the whole rather better installed than at the Copper Cliff mine. The roast beds, however, were placed all about the grounds, and could not be so economically handled. We counted 26 heaps in all, and estimated there was about 13,000 tons of ore upon them.

In the smelting works is one furnace similar to those at the Canadian Copper Company's works, with similar accessories. They had not more than ten tons of matte on hand, in two heaps, which they claimed to assay 30 and 33 per cent. of nickel. We procured samples from each pile, which can be assayed if the department directs. The manager claimed that the company owns 5,000 acres of land, upon which were nine places they contemplated working, six for copper and three for nickel. He spoke of the Worthington mine as being the richest, and gave us a sample of ore which he claimed would assay 40 per cent. nickel. He said that one shaft had been sunk 72 feet (Crean mine), one 25 feet (Worthington mine), and at four other places cross-cuts had been blasted. Although the deposits at Crean mine as shown on the map had been represented to us as worthless, owing to his representations we visited them.

The Worthington mine is situated on the Algoma branch of the C.P.R., about seven miles west of White Fish Station. We found a mound about 30 feet high and 50 in diameter, with a small shaft sunk in the middle about 25 feet deep. From it had been taken a few tons of ore, which appeared quite rich in nickel. The man in charge, however, said it appeared to be only a pocket, and that the end had been probably reached. He mentioned one very fine specimen of ore, half of which he had sent to the principal office, and showed us the other half of the piece we had in our possession. As the property is alongside a railroad now seven years in active operation, it seems reasonable to suppose that it does not pay to work.

The Crean mine is within a few hundred feet of the Worthington. The shaft was sunk by previous owners to a depth of about 70 feet, and was abandoned as unprofitable. No work has been done on it since.

H. H. VIVIAN & COMPANY.

The Murray mine is situated on the main line of the C.P.R., 2½ miles north-west of Sudbury. The railway cuts through the deposits. On the left side is a hill about 75 feet above the track, and extending about 300 feet perpendicular to and 150 along the same. This embraces all the deposits claimed on this side of the railroad. On the other is a mound about 15 feet high, and extending 100 feet perpendicular to and 70 along the track. Both of these are evidently of ore-bearing rock. Beyond the mound on the north side of the track, across a marsh about 100 feet wide, another small deposit was visible, which the manager claimed extended to the north-east for miles, he knew not how many. They were making no preparations to work these latter deposits, and their existence is disputed. The manager says another company owns the section north of them, but beyond that they owned a large territory.

There is one shaft sunk in the hill on the south side of the track to a depth of 60 feet, and from this they are taking small quantities of ore, which is handled in hand barrows. They have a small crusher of not over 75 tons capacity per diem. The furnace is of the English pattern, the same as used in the company's works at Swansea, England. It can reduce about 40 tons of ore per diem, and has been in operation about three weeks. Another similar but larger furnace is building. The works are not economically planned for working on an extensive scale.

Eight thousand tons of ore have been mined in the last year and a half, since the mine was opened. The ore runs about two per cent. of copper and nickel combined.

The matte is 8 per cent. nickel and 4 per cent. copper. The manager said he had orders to mine 40,000 tons next year.

The place cannot be in any way considered as a competitor of the Canadian Copper Company.

GENERAL SUMMARY.

	Canadian Copper Co.	Dominion.	Vivian's.
Acres owned known to us............	13,000	480	320
Additional claimed...	....	5,000	4,000
Amount of ore taken from mine to Oct. 1	105,000	45,000	8,000
Daily crushing capacity, ore.........	1,200	400	150
Daily furnace capacity, matte.......	72	14	5
Estimate of tons of ore above surface of ground in deposits seen by us..	650,000,000	2,500,000	240,000

We visited the Fraser & Chalmers Company, and the Gates Iron Works, in Chicago, where the various statements concerning the capacity of the plant and embodied in this report were verified.

Very respectfully,

Wm. M. Folger,
Commander U. S. Navy.
B. H. Buckingham,
Lieutenant U. S. Navy.

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Examination of Mineral Properties.[*]

By Prof. H. S. Munroe.

The mining engineer, when called upon to examine a mineral property, should be prepared to answer the following questions, or their equivalent :

1. *Will it pay to work this deposit ?*

2. *How much capital will be required to develope and work the property ?*

3 *What is the property worth ? Do you advise its purchase at the price asked ?*

These questions involve more than is apparent at first sight. It may sometimes happen that the deposit is so large and rich, or so small and poor, that the first and most important of these questions can be answered at once. In such cases, however, the services of the mining engineer will hardly be required.

If it is at all doubtful whether the property is workable or not, we must ascertain the extent of the deposit, its average thickness and the probability of its continuance. We must determine the richness and purity of the mineral, and other things having influence on its market value. Finally it will be necessary to estimate the cost of mining and of preparing the mineral for market, the cost of transportation and the probable selling price. Each of these new questions will suggest further lines of investigation. For example, the cost of mining will depend largely on the scale of operations, and this, in turn, on the extent of the deposit, the market for the product, and many other things.

The value of the property depends on its capacity for earning profits or dividends, to determine which demands most careful and accurate estimates of capital, working costs and probable production, as well as the time required for the different operations, as affecting the question of interest.

Many, if not most of these things, are usually guessed at. The value of the estimates and conclusions in such case depend on the guesser's ability and previous experience in the particular kind of mining in question, and on his familiarity with the local conditions affecting the result. Such guesses are often far from the truth, and the consequences disastrous both to the reputation of the guessing expert and to those who invest their money on his recommendations.

The object of the present series of papers is to outline a method of procedure by which data can be obtained for careful estimates, and much of the uncertainty now attending the inception of mining enterprises removed.

It rarely happens that questions involving the scale of operations, the amount of capital required and the value of the property can be answered definitely, or even guessed at, until the nature and extent of the deposit have been determined by exploratory workings, costeaning ditches, drifts, bore-holes, prospecting shafts, etc.

Often large amounts of money have to be expended in such preliminary work before the true character and value of the deposit is known. Sometimes, indeed, it is even necessary to develope and work the deposit on a small scale before these questions can be definitely answered.

The examinations made by the mining engineer will then be of two kinds.

1. A preliminary examination of the undeveloped or partly developed property to determine whether further exploratory work is warranted by the "prospects," and if this prove to be the case, to decide upon a systematic plan of exploration which will give the desired information as to the nature and extent of the deposit.

2. A final and exhaustive examination of the property to obtain data to determine the best method of working, the scale of operations, the amount of capital required and the probable earnings and consequent money value of the property.

PRELIMINARY STUDIES.

Before undertaking the preliminary examination the engineer should make himself familiar, as far as time and opportunity permit, with similar deposits in the same region and elsewhere. The study of developed properties, their history and the conditions under which mining has proved profitable, will be of great service. In some regions an ore yielding one or two dollars to the ton can be worked with profit. In other regions, under different conditions, an ore yielding twenty dollars will not pay expenses. In this study of similar deposits the engineer should also note carefully the associated rocks and characteristic minerals, the mode of occurrence of the useful minerals, and, in general, such features of the deposit as influence the value of the property and determine the mode of working.

In default of opportunity to examine similar deposits, much information can be obtained from geological reports, state and governmental ; from the reports made by geologists and engineers on adjoining or similar properties ; from the transactions of scientific and engineering societies, and from articles and correspondence in the technical journals. Finally it is assumed that the engineer is familiar with the literature of ore-deposits, and has had practical experience in mining operations and in field geology. Nothing, of course, can make up for the lack of this knowledge and experience.

PRELIMINARY EXAMINATION OF THE PROPERTY.

In the preliminary examination of the property the following objects should be kept in view :

1. Endeavor to determine the geological character of the deposit, as for example, whether it be a regular bed or vein, or an isolated mass or impregnation.

2. Determine carefully the thickness and other dimensions of the deposit where exposed ; its dip and strike, the occurrence of folds, squeezes, faults and other irregularities, and the nature of the surrounding or overlying rocks and soils.

3. Note the relations of the deposit to the surface topography, and to the natural lines of drainage and of transportation.

4. Determine the relations existing between different exposures of mineral on the property, and whether they are on the same or represent different deposits ; also the relations between the deposit and exposed rock-formations.

TOPOGRAPHICAL SURVEY.

As a basis for this work a topographical map of the property is indispensable. It is only necessary to enumerate some of the possible uses of such a map to make this evident :

1. The relations of the mineral deposits to the property lines can be seen ; and steps taken, if necessary, to secure or control adjoining properties before the work of exploration and development is begun.

2. The relation of the different outcrops and developments, and whether they represent one deposit or several, can be determined : sometimes at a glance.

3. The area of the portion of the property underlaid by the deposit can be measured, and the available areas of mineral at certain depths and within certain boundaries determined.

4. If the geological structure be complicated, all the known data can be brought together on the map and sections, and advantageously studied.

5. The probable outcrop line can be determined and traced on the map as a guide to works of exploration and development.

6. If necessary, the underground contours of the deposit can be determined approximately ; and the probable depth of a shaft, or the length of a tunnel, to reach the deposit can then be measured on the map.

7. Roads, buildings, and all surface works, and in general all the works of exploration and development can be much better located and planned with the aid of an accurate map than is possible without such assistance.

SURVEYING FIELD-WORK.

When the property is small, or the problems simple, a sketch map will serve every purpose. This may be based on an outline plot from the description in the title papers.

When time and the importance of the work permit, a careful topographical survey should be made. All outcrops of the deposit, and of overlying and underlying rocks, should be plotted on this map in their true positions. From the measurements of dip and strike and level it will be possible to construct geological cross-sections and to determine the probable lines of outcrop as a guide to further exploration. Finally, the costeaning ditches, prospecting shafts, and other exploratory workings should be plotted from time to time on this map and on the sections, that the full import of the new developments may be studied as the work goes on.

When the property is covered with timber and underbrush the topographical survey may be made by the rectangular system. When the country is open, however, other more rapid and economical plans of work should be adopted. The expert topographer will not confine himself to any one system of work, but will in every case adapt his method to the conditions by which he finds himself surrounded.

If the rectangular method be adopted the base should be run along the line of the principal developments. From this base laterals will be run, 200, 300, or 500 feet apart, and prolonged as far on either side of the base as may be necessary. These laterals should be joined at their extremities by tie-lines parallel to the base line to check the accuracy of the work. The lines will be run with range-poles, by the compass, or by the transit, and the distances measured by pacing, chaining, telemeter, or steel tape, according to the importance of the work and the degree of accuracy required. To facilitate plotting the stations on these lines should be located at uniform distances, 200, 300, or 500 feet apart, and sub-stations interpolated when necessary for details. Finally, the levels of all stations will be determined by barometer, hand-level, water-level, or wye-level, according to the degree of accuracy desired. If the barometer be used, continuous readings should be taken at some reference point to determine the fluctuations of the barometric column during the day. A self-registering aneroid may be used for this purpose.

The contours should be sketched in the field, and not constructed in the office from the levels of the stations, as is too often done. This is especially important in the survey of mineral properties, as the configuration of the surface often throws much light on the underground structure.

When the country is free from underbrush the survey may be made with the transit and telemeter-rod. A series of closed polygons will be run along roads, ridge lines, and lines of natural drainage. From the main stations on these traverse lines sub-stations will be determined by radiating sights and telemeter readings. More distant points may be located by intersecting cuts. Vertical angles will be freely used for determining differences of level.

If the country be open much time will be saved, and the accuracy of the work increased by triangulation and by the use of plane-table methods. In many cases the plane-table itself may be used to advantage.

For open country, also, surveying by photography,[*] the camera being used as an angle-measuring instrument, will doubtless find increasing application. Not the least of the advantage of a photographic survey is the short time required for the field work. The photographs also supplant the map, and reveal details of topography which would otherwise be obscure.

GEOLOGICAL FIELD-WORK.

A careful and systematic geological examination of the property will be made in connection with the topographical survey. All outcrops of mineral and of associated rocks should be examined and located on the map in their true position, elevation, and extent. The dip, strike, and thickness of rock exposed should be noted in each case, that the data may be accurately plotted on the sections.

Search for outcrop should be made on steep hillsides, on the crests of hills and ridges, in the beds of streams, in the roots of overturned trees, and in wells, cellars, quarries, road-cuttings, and other artificial excavations.

Even when the solid rock is not exposed the decomposed rocks and soils may furnish an indication of the character of the underlying rock. This, of course, is not the case in alluvial valleys, nor in regions covered by glacial drift. Elsewhere the decomposed rock, often 20, 50, or even 100 feet thick, remains nearly *in situ*. Sometimes the vegetation, shrubs, trees, etc., as characteristic of certain soils, may furnish important clews to the nature of the underlying rocks and minerals.[†]

Search should be made in the beds of streams and on hillsides for "float mineral" or "shoad stones," and for fragments of rocks and minerals known to be associated with, and characteristic of, the deposit. By tracing such float up the stream, or up the hillside, the outcrop may sometimes be found, or at least approximately located.

The outcrop of a metalliferous vein frequently manifests itself as a line of rocks stained with oxide of iron, often honeycombed and porous, the "*gossan*" or *eisen-hut*, the iron oxide of which results from the decomposition of the pyrites, usually present as a constituent of such veins.

The bed of fire-clay under a coal-seam, being impervious to water, frequently determines the horizon of numerous springs issuing from the hillsides. As the coal and the associated rocks usually contain pyrites these springs are often chalybeate.

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[*] School of Mines Quarterly.

[*] *Photography Applied to Surveying.* Lieut. H. A. Reed. Wiley & Son, 1888. Also, *Modern Methods and Apparatus for Surveying.* H. S. Munroe, *Trans. Am. Inst. of Mining Engineers*, vol. xviii. (in press).

[†] See "Indicative Plants." R. W. Raymond. *Trans. Am. Inst. Mining Engineers*, vol. xv., p. 644.

RELATIONS OF TOPOGRAPHY TO GEOLOGICAL STRUCTURE.

Finally, the topography of the surface, if carefully studied, will often throw much light on the underground structure.* The ravines and valleys are formed by the gradual erosion of the surface. The shape of the resulting hills and ridges is necessarily influenced by the inclination of the strata, by the relative hardness of different rock-beds, and by the presence of folds and fissures and other lines of weakness. A quartz-vein or bed of hard rock may show itself as a sharp ridge or as a well defined bench; and a stratum of soft rock, or the line of a great fissure, or the weakening of the strata by an anticlinal fold may produce a ravine or a deep valley. A break in the line of a ridge of hard rock may prove to be due to faulting, and in such case is often accompanied by the lateral displacement of the ridge beyond the fault. In regions where the strata are horizontal the small streams often will be found in deep ravines with precipitous banks. When the rock-beds are inclined the ridges will usually follow the strike of the rocks, and one hill-slope will be gentle and the other precipitous.

The importance of care and accuracy in the topographical work is evident. If the contours be carelessly drawn important truths may be concealed or false inferences deduced.

MAP AND SECTIONS.

The field work completed, the data will next be plotted, and the lines of probable outcrop of the deposit traced upon the map as a guide to prospecting operations. If the deposit be a bed or fissure-vein, and the plane of the deposit can be approximately determined, the tracing of the outcrop line is comparatively simple, involving merely the application of the principles of descriptive geometry. If the plane of the deposit be a warped surface, or combination of such surfaces, as in the anthracite coal-basins of Pennsylvania, the tracing of the outcrop is more difficult. The best method of procedure in such case is to construct from the data obtained in the field, and platted on the map, a series of cross-sections. In projecting the measurements of dip into these sections, due allowance must be made for the inclination of the strata from or toward the section where the lines of strike are not normal to the section. Allowance must also be made for the curvature of the lines of strike in some portions of the basin. From the cross-sections so constructed the approximate shape of the basin can be determined and the underground contours of the deposit sketched. Each intersection of an underground contour line, with a surface contour line of equal elevation, marks a point of outcrop. Joining these points by a continuous line we have the required outcrop.

PROSPECTING.

In order to answer definitely the questions asked at the beginning of this paper it is evident that we must know at least approximately the amount of available mineral, as well as its richness, purity, and other circumstances affecting its value. To form a reliable estimate of quantity it is necessary to know the extent of the deposit and its thickness. The area within the definite boundaries and above any assumed level can be determined from the map and sections. Thickness must be measured. It is not enough to know its thickness at one or two places only, but we must know the average thickness. The greater the number of measurements that can be made the more accurate will be the average result. In like manner a large number of samples from different parts of the deposit will be necessary to determine the average quality and richness of the mineral.

The work of prospecting, then, should be conducted so as to expose as much of the deposit as possible, to enable the measurements to be made and the necessary samples secured.

The exploratory workings are of two kinds, surface and underground; the first directed toward uncovering the outcrop of the deposit, and the latter to prove the deposit in depth. Both are necessary. Too much importance, however, should not be attached to workings in depth, and the surface exploration should in no case be neglected. The outcrop of a mineral vein or bed may be altered by weathering, and may be richer or poorer, better or worse, than the unaltered deposit below. Apart from this the outcrop represents an average section of the deposit, and measurements made on the outcrop will probably represent the true average thickness of the vein. The outcrop represents a section produced by erosion, possibly thousands of feet below the original outcrop. It is not probable that an artificial section, obtained by underground workings a hundred feet or so lower, will be any more reliable in this respect. In most cases there is no reason why a vertical section made by a shaft should have any greater weight in the determination of average thickness than a horizontal one.

Surface explorations are far cheaper, are more rapidly executed, and permit a more satisfactory examination of the deposit than underground excavations.

Underground workings are, however, necessary to determine how far the deposit has been altered, and the richness or quality of the mineral changed by weathering. The results will enable the proper correction to be applied to the data obtained in the examination of the outcrop.

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*See *Coal and its Topography*. J. P. Lesley. Philadelphia, 1856. Also *Topography with Especial Reference to the Lake Superior Copper District*. J. G. Blandy. *Trans. Am. Inst. of Mining Engineers*, vol. i., p. 75. Also, *On the Importance of Surveying in Geology*. Benj. S. Lyman. *Trans. Am. Inst. of Mining Engineers*, vol. i., p. 183.

Meeting of the Excelsior Copper Company, (Limited).

An extraordinary general meeting of the shareholders of this Company was held on Friday, 24th ult., at the Cannon Street Hotel, London, for the purpose of considering and passing certain resolutions for winding up and reconstructing the Company. Col. Malleson presided.

The SECRETARY (MR. G. R. FENWICK) read the notice convening the meeting, after which

The CHAIRMAN said: In the month of April last we held an ordinary meeting of the shareholders of this Company. On that occasion Captain Davey (the mining captain of the Company), who had just then returned from Canada, gave his report as to the value of the mine. He then pointed out that it required a certain sum of money—about £20,000, I think it was—to bring the mine into a dividend-paying condition. It was after that ordinary meeting that the meeting resolved itself into an extraordinary meeting for the purpose of considering the ways and means of the company, and how best to raise the £20,000 required for the development of the mine. It was finally decided by, I think, an absolutely unanimous vote, that the money should be raised by the issue of debenture bonds. We sent out circulars in conformity with that resolution, asking the shareholders to subscribe to the debenture bonds, the directors pledging themselves to subscribe in equal proportion if anything like the sum required should be subscribed by the shareholders. I regret very much to tell you that the reply of the shareholders was not satisfactory. The amount subscribed was so small that it was returned to those who had subscribed, and the directors set themselves to work to try and find out whether there were any other means by which, by subscriptions, among themselves and their friends, they could carry on the development of the property. The value of the property has been proved right up to the hilt, and if any of the shareholders would like to hear anything on that subject, I am happy to tell them that Captain Davey is in the room, and if they wish it he will address them on that subject. Under these circumstances, and having failed to obtain the money required for the development of the mine by debentures, your directors came to the conclusion that the only way in which it might be obtained was by reconstruction, on the basis of imposing on the shareholders a payment in proportion to their several holdings. This will be carried out by the issue to the present shareholders of shares 18s. 6d. paid. That is to say, that each shareholder in the new Company will be liable for a subscription of 1s. 6d. on every share he may hold in the old Company. But, although he becomes liable for 1s. 6d. per share, it does not at all follow that he will be required to pay up that sum. I myself am of opinion that 1s. per share will be the total amount that may be necessary to call up, and I see gentlemen before me who are sanguine enough to think that even 6d. will be sufficient. At all events, whether it be 6d., whether it be 1s., or whether it be 1s. 6d., the amount is small in proportion to the great value of the mine which is your property. The value of the mine, as I said before, is placed absolutely beyond the realm of doubt. I shall content myself now by moving the first resolution: "That it is desirable to reconstruct the Company, and that with a view thereto, the Company be wound up voluntarily."

MR. J. R. ARMITAGE seconded the resolution, which was then put and adopted, with two dissentients.

The CHAIRMAN moved that the liquidator be authorized to transfer to a new Company, to be incorporated with limited liability under the Companies Acts, 1862 to 1890, all and singular the lands, hereditaments, mines, mining water, and other rights, leases, buildings, plant, machinery, stores, and all other the property and effects of this Company, of every description whatsoever, upon the terms and conditions named.

MR. BATTINSON seconded the resolutions, which were then put and carried unanimously.

CAPTAIN DAVEY then said: Since I last met you at this place I have been out to Canada, where I went with the intention of working a diamond drill in connection with the property; but, as the Chairman just now stated, the money which was proposed to be raised by the Canadian Board was not forthcoming, so we had to work with the limited means at our disposal from this side. We commenced on the dump ores with the most primitive method possible to adopt—three wash tables, one hand jigger, and one buddle. All the stuff was put through a screen, the rough being picked by boys, and the fine treated in the jig and buddles. As a result of that we sent to Swansea eighty-seven tons at a cost of about £340. When we can work our concentrating plant we shall have some good ore to comence with. I calculate to have on the dumps about 10,000 tons ready for treatment. We have sent over, as I have told you, 87 tons of ore averaging from 11 to 24 per cent. This, I am sure the shareholders will say, is a good average for dump ore. But, taking the ore at an average of only four per cent., this will give you a grand total of 400 tons of copper or metal, equal in value fo £20,000 sterling at the present price of copper. The whole quantity can be brought to market at half that amount, or £10,000, which will include the cost of plant for treating it. Thus you will be left with a profit of £10,000. What is already broken at the surface is one of the best assets on the Company's property. To treat the dumps you require, in my opinion, a mill and concentrating plant to treat 100 tons of stuff per day. This will cost you £3,000 when erected. In treating four per cent. ore as above you will get (counting one per cent. for loss) three tons of metal per day, or equal to £180 per day, taking the value at £60 per ton. From this deduct £8 per ton for smelting, and you have to the good £156 per day, or £4,368 per month of twenty-eight days. This estimate is taking the stuff at 3 per cent., but it ought to run to 6 per cent., and, if so, be all the more valuable. If £2,000 be taken for mining, milling, and smelting, there will still be left to you a monthly profit of £2,368, or £28,416 for the year. This I consider a good profit on an outlay of £3,000. During the past two years your mine has been worked with an idea to get out all the available ore, without the least thought of where the ore is coming from after the then reserves were worked out. They have worked up to this point, but there is not an and in advance of a stope, and the stopes are shallow and poor generally. The work has been on both vein and bed-rock, and stoped wherever there has been a sign of ore. I am satisfied that you have a valuable property if only it is fully developed. I don't hesitate for one monent to say that if the money is raised, before this time next year you will have a dividend. I may be told that that is a rash promise on my part, but it shows the confidence I have in the mine. There is also asbestos on the property, and I think, with a little looking after and a little prospecting, we shall not only have copper ore, but also asbestos, and that, as you know, is a very valuable commodity.

In answer to questions, the CHAIRMAN said that in future the Company would only have directors in England. The directors had given fullest consideration to various schemes for the raising of capital, but it was felt that in the present state of the money market it was absolutely inadvisable to appeal to the public for assistance.

The proceedings shortly afterwards closed.

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A Summary of the Quebec Mining Bill.

This Bill, which has been passed at the late session of the Legislature of the Province of Quebec, may be summarized as to its principal features as follows:—

In all future sales of lands for agricultural purposes, the Crown reserves the mining rights.

Any person discovering a mine may purchase it; but upon private lands the occupant of the surface has the first right to purchase.

From May 1, 1891, a royalty shall be levied of 3 per cent. of the merchantable value of the products of all mines and minerals (unless the amount is already determined otherwise). The royalty on gold is to be 2½ per cent. of the gross weight estimated at $18 an ounce, and on silver at 2½ per cent. of the gross weight.

For a fee of twenty cents one may see the registers and plans in the mines office.

Inspectors may be appointed by the Lieutenant-Governor, under the control of the Commissioner of Crown Lands.

The inspector has the powers of a justice of the peace, and decides in a summary manner, without appeal, all contestations and suits relating to mining, except in suits relating to rights or titles to immovable property. He may summon persons, convict upon view and settle any difficulty arising from the provisions of the Act.

Any one may explore and prospect on public lands.

An exploration permit, valid for three months, giving the right to make all necessary works, may be obtained by paying, if upon private lands, $5 for every 50 acres, or if upon Crown lands, $10 for every 50 acres.

The mine may afterwards be purchased at a minimum price of $2 per acre for iron and ochre, or $5 per acre for all other minerals.

The Commissioner may offer mining concessions at public auction, the upset price, or first bid, to be as above.

A mining concession is to be not less than 50 nor more than 100 acres.

The deed of sale may be annulled if work ceases for two years, unless work is resumed within twelve months after notice.

Arbitrators shall decide, if necessary, the compensation to be given to private owners by the intending purchaser of mining rights.

If the purchaser of a mine from private persons does not go to work within two months, or if he discontinues work for eight months his title is forfeited.

Reports must be sent to the Commissioner on the tenth day of January, April, July, and October, containing statements of ores worked, number of men employed, and description of all mining work and erection of plant during the quarter.

Quartz mills may be licensed for $5.

Mill owners must make monthly returns.

Numerous provisions relate to the duties of inspectors and land surveyors, the duty of owners to erect posts and and mark boundaries, keep passage walls clear, etc., etc., and the powers of the Lieutenant.Governor to aid and regulate mining or control riots.

Maximum penalties are to be imposed as follows:

For mining without permit—$10 for every day or imprisonment for one month.

For mining without furnishing name, etc. to inspector—$20 or one month.

For obstructing passage—$5 or one month.

For damaging another's mine by earth or water—$5 or one month.

For not complying with inspector's decisions about use of water courses, drains, etc.—$50 or one month.

For removing a stake—$10 or one month.

For using a quartz mill (other than hand-worked) without license—$100 or two months.

For omitting to send returns of mill work, for every day's delay—$20 or one month.

For not putting a fence four feet high around every pit of four feet or over in depth, not having been worked for eight days—$50 or one month.

For taking a share in a mine by an inspector—$400 or one year.

For refusing entrance or assistance to inspectors—$5 or one month.

For refusing to appear as a witness—$5 or imprisonment until consent.

For all other misdemeanors, for every day of contravention—$20 or one month.

For neglect to set up or replace posts—$100 for each post.

For removing or damaging posts—$100 for each offence.

For preventing arrest of offenders—$40 or two months.

Fines wholly recovered in the name of a complainant, are to be paid half to the complainant.

Liquor cannot be sold without a license within seven miles of a working mine.

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Anthracite Mine Surveying.*

By R. Van A. Norris, E.M.

As the mining laws of Pennsylvania require accurate mine maps to be filed with the inspector of mines in each district, very extensive underground surveys are continually being made in the anthracite districts, all the larger corporations having their own corps of salaried engineers, and the smaller operators depending upon independent engineers who do the work either by contract or for fees.

The methods of surveying are almost as varied as the number of engineers. The following is the method used by the Susquehanna Coal Company, Mineral Railroad and Mining Company, Lykens Valley Coal Company and Summit Branch Railroad Company, corporations under the control of the Pennsylvania railroad, and it is believed to be as good as any other system in use.

The corps, as it goes into the mines, consists of a transit-man, station-man, backsight, foresight and chain-man, with a fire-boss to attend to the safety of the party. The three-tripod method of surveying is used, but instead of tripod lamps, the wicks of which were found too large for accurate sighting, similar lamps are used with the wick replaced by a steel wire $\frac{1}{16}$ of an inch in diameter and ⅜ of an inch high. The sights are always taken to the bottom of this wire, and measurements are taken on the line of sight with a steel tape 300 feet long, graduated every 5 feet.

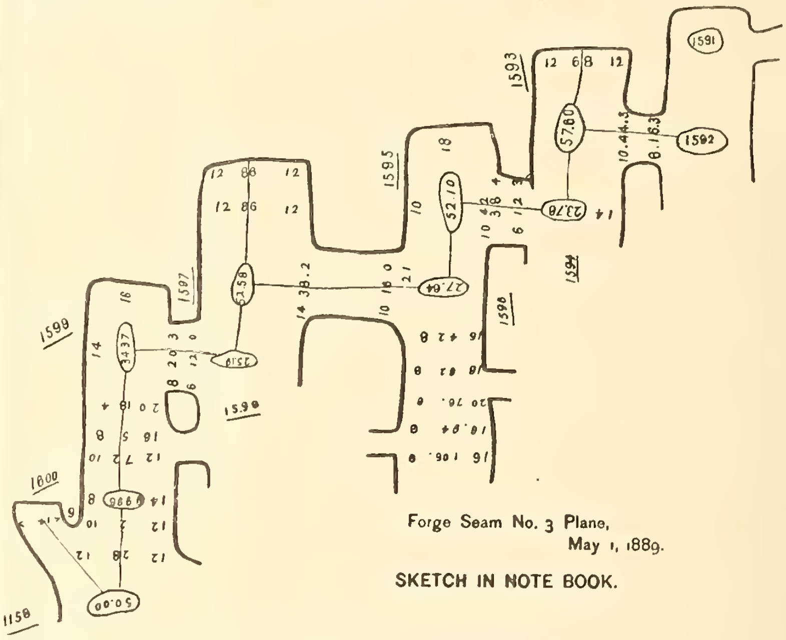
When in the mine, the station-marker keeps ahead of the party, and puts in and numbers the instrument stations. There are three ways of making permanent (?) stations in the roof in vogue in the region. A small conical hole is sometimes drilled, and the bob suspended from an iron rod with a notched end fitting the cone of the hole. With these stations, which are used principally with high roofs, the point is transferred to the floor by holding a bob with the iron rod, and placing some mark under it, usually a small bit of coal in the centre of a dab of white paint, the instrument being set up over this. This method has a greater liability to error than either of the others. A second method is to put a horseshoe nail, with a hole punched in the end, into a plug of wood driven into a drilled hole in the roof, and then to suspend the plumb from the ring, and set up the transit under the bob. A third and more convenient way of effecting the same thing is to drill a $\frac{1}{16}$ inch diameter hole in the roof with a twist drill, and put a shoe-peg, holding a small loop of fine (No. 26) copper wire, in the hole. We have used this style of station largely, and find it a most satisfactory one, the wire being flexible enough to allow the bob to hang true; and the station, with its ring of white paint and painted number, being readily found and never confused with any spads put in by the mine bosses.

The station marker is supposed to be familiar with the mines and with the engineer's methods of mining, and usually places his stations advantageously, being guided in some measure by the light of the fire-boss ahead of him and by the foresight's light behind.

The foresight-man carries the forward tripod with him, and sets up under the station, plumbing to the wire on the "lamp," then holds his light to give foresight to the transit-man. He then waits for the chain-man to come up, and assists with the chaining. The transit-man, after taking a sight and making the proper notes, follows the chain forward, making the sketch and taking the side-notes. Reaching the next station, he takes the exact distance on the tape with his pocket tape, measuring to a clip which has been put on by the foresight-man when the 300 feet tape was stretched. At the new station he finds his instrument, which has been removed from its tripod and brought forward to him by the backsight-man. As soon as the transit-man gets a satisfactory backsight on his old station, he calls "move up," and, while he is taking his angle, the backsight brings up the rear tripod and hands it to the chain-man. He then holds the end of the tape while the chain-man goes forward with the reel and tripod. By the time the angle is taken, the chain should be ready to stretch, the transit-man being responsible for the zero end, and the foresight for the other. As soon as the chain is stretched and the distance clip put on, the foresight-man takes the tripod brought to him by the chain-man and the lamp from the tripod to which he has just measured, goes forward, and sets up under the next station, the chain-man and backsight-man meanwhile holding the chain for the transit-man to take his side notes from.

The accompanying notes, sketch and map are from regular work, being taken at random. In the notes, the instrument station and foresight station are entered thus: 1592–1593, the backsight being understood to be the previous station unless otherwise entered at the beginning of a survey, thus: Bs. 1287—1562—1563.

Continuous azimuth angles are run, plunging the instrument at each station, and the entries in the note-book consist of the vernier reading on a continuous graduation, 0° to 360°, and also the quadrant reading or course. The compass reading is taken roughly, and has been found of great service in finding errors caused by reading in the wrong quadrant, or mistakes of even degrees. In starting, the vernier is set to the course of the starting stations taken from the note-book. The method has the disadvantages of danger of the plates slipping while the transit is being carried between stations, and that any error in adjustment of the instrument vitiates the survey; but, on the other hand, the courses are obtained directly, and, as all surveys are closed, any error is seen in the mine and the line re-run. In practice we find that a close more than 3′ out for a chain of fifteen or more stations is very rare.



Forge Seam No. 3 Plane,
May 1, 1889.

SKETCH IN NOTE BOOK.

May 1, 1889.—Continuation of Survey on No. 3 Plan.

Stations.	Courses.			Distances.			Elevations.			Rem'ks.
	Needle.	Angle.	Course.	Vert. Ang.	Tape.	Hor. Dist.*	Ht. Inst.	Rod.	Elevation.	Vert. Dist.
1591–1592	....	......	N. 85° 24′ E.	....	.....	......	—1.45	......	+233.89	....
1592–1593	S. 4° E.	173.46	S. 6° 14′ E.	—6° 00′	57.60	57.28	......	+1.90	+228.32	—6.02
1593–x	N. 82° W.	......	N. 83° 50′ W.	....	68.	......	......	......	....	Face.
1593–1594	N. 85½° E.	84.21	N. 84° 21′ E.	—2° 56′	22.76	22.73	......	+2.25	+228.01	—1.16
1594–1595	S. 8° E.	170.45	S. 9° 15′ E.	—5° 46′	52.10	51.83	......	+2.05	+223.08	—5.23
1595–1596	S 88° E.	91.24	S. 88° 36′ E.	—3° 07′	27.64	27.60	......	+1.85	+221.88	—1.50
1596–x	N. 87° E.	......	N. 85° 30′ E.	—2° 15′	106–	105.92	......	......	....	....
1596–1597	S. 4½° E.	174.20	S. 5° 40′ E.	—5° 56′	52.58	52.30	......	+1.85	+216.95	—5.43
1597–x	N. 85° W.	......	N. 86° 50′ W.	+1° 30′	86—	......	......	......	....	Face.
1597–1598	N. 86° E.	84.59	N. 84° 59′ E.	—3° 42′	25.19	25.13	......	+2.10	+216.08	—1.62
1598–1599	S. 1° E.	177.33	S. 2° 27′ E.	—4° 00′	34.37	34.28	......	+0.90	+212.99	—2.39
1599–1600	S. 73° E.	107.50	S. 72° 10′ E.	—5° 29′	99.96	99.50	......	+1.90	+204.94	—9.55
1600–1158	N. 81° E.	80.12	N. 80° 12′ E.	—4° 01′	50.00	49.87	......	+1.10	+201.14	—3.50
1158–1157	....	......	N. 78° 55′ E.	Close.	1′out.	......	......	......	....	....

*Calculated in Office.

The verticle angles are read very carefully, as level is carried with the instrument. On this account the "lamps" were made of such a height that the bottom of the sight-wire is just $\frac{5}{10}$ foot below the centre of the instrument.

The column headed "rod" gives the distance from the centre of the instrument to the station in the roof, so that the calculation for the level is thus:

Elevation 1594 .... 228.01
Rod at 1594 .... 2.25

Elevation of instruments at 1594... 225.76
Calculated vertical distance........... 5.23

Elevation of lamp at 1595........ 220.53
Height instrument over lamp.......... 50

Height instrument at 1595....... 221.03
Rod at 1595....................... 2.05

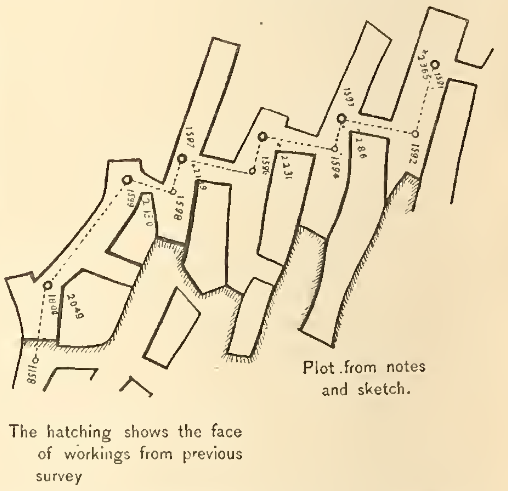
Elevation of station, 1595........ 223.08

In this way level is carried through the workings, being checked by lines run in the gangways with a level. The method is found to give results sometimes surprisingly accurate, to within $\frac{1}{10}$ foot for lines containing 50 or more stations, and a difference of over one foot in the transit and level elevations is rare.

Working in this way it is possible to attain great speed, from 40 to 50 stations being considered merely a fair night's work.

As many of the seams are only reached by vertical shafts, it is necessary to "plumb" these before starting the underground surveys; two methods of accomplishing this have been used by the Susquehanna Coal Company at Nanticoke.

1st. Two 15-lb. iron plumb-bobs are lowered, attached to No. 20 steel wires, one on each side of the shaft, and the instrument is put in line with the two wires on the surface and again underground, continuing the surface line; the objections to this are the very short base line, as the sight has to be taken in one compartment of the shaft, the base is seldom more than 8 or 9 feet, and the difficulty has to be encountered of keeping the bobs in a 1000-foot shaft from swinging; they can be steadied considerably by immersing each in a bucket of heavy oil, but at the best they will swing somewhat. This method, however, gives very accurate results if great care is used in aligning the transit at the bottom of the shaft, and is, perhaps, the preferable one.



Plot from notes and sketch.

The hatching shows the face of workings from previous survey

The other method is to hang the two wires at opposite sides of the outer compartments, and fix two stations under ground, and measure the angles and the sides of the resulting quadrilateral, and from these calculate the course between the stations, the course between the wires being obtained on the surface by putting them in line with the transit or by a method similar to that just outlined. The greatest objection to this method is that even a very small error in measurement, and it is not a very easy matter to measure accurately to a wire swinging in a wet shaft, will introduce serious error in the results.

Recently the two systems of plumbing were compared with a line run from the surface down two slopes and a plane, and with about a mile of underground traverse, and the three courses agreed to within a half minute, the first system of plumbing and the traverse line (which was run very carefully with an instrument reading to ten seconds) agreeing exactly.

All gangway stations are plotted from calculated latitudes and departures, and the stations in the workings filled in by plotting with a protractor; the outline of the workings is then filled in from the sketch taken in the mines. In making this sketch the transit-man walks along by the tape, and, taking his distance from that, measures at intervals to the rib at either side and to all openings passed; this measurement is usually, by experienced men, done by the eye; at the station the distance is put on the sketch, the number of the station being afterwards supplied from the notes. In surveying the breasts, either a line is run through the headings, as was the case in the accompanying notes and sketch, or, where this is impracticable, either on account of pitch of seam or gas, a line is run up every third breast noting all headings and the two intermediate breasts sketched in by measurements through the headings.

On many corps where the three tripod method is not in use, an extra man is employed, whose sole duty it is to take the side notes and make the sketch.

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* School of Mines, Quarterly.

Annotated List of Canadian Minerals.*

G. C. Hoffman, F. Inst. Chem., etc.

(Continued from page 185.)

183. Niccolite—Has been found, in admixture with domeykite, in a vein cutting a bed of amygdaloid on Michipicoten Island, Lake Superior, Province of Ontario. Anal., T. S. Hunt, Geol. Can., 1863, p. 506.

184. Nitre—Has been found in cavities in calcareous tufa, on the Nazco River, and has also been met with at Big Bar, Fraser River, Province of British Columbia.

185. Obsidian—Is found in large and small masses on the higher eastern slopes of Il-ga-chuz Mountain, but the most notable locality for this mineral is the mountain named Beece or Anahim's Peak, an isolated summit between the Il-ga-chuz and Tsi-tsutl Mountains, in the upper Blackwater country (G. M. Dawson, Rep. Geol. Can., 1876-77, pp. 78, 79): it also occurs at Tsooskatli, the upper part of Masset Inlet (on a small islet north-east of Tas-kai-guns), Queen Charlotte Islands (id.—ib., 1878-79, p. 88 B), and other localities in British Columbia.

186. Octahedrite—Is reported, by Prof. How, as occurring in small but fine crystals, in quartz, at Sherbrooke, Guysborough County, Province of Nova Scotia.

187. Oligoclase—Occurs in more or less perfect crystals, in groups, of a white or faintly greyish-white color, in the Township of Hull (Ottawa Co.), and a white, rarely greenish or greyish, felspar, having the composition of oligoclase forms, with black hornblende, the intrusive diorite of Mount Johnson (Iberville Co.), Province of Quebec. A white to pale grey felspar, also referable to this species, is the constituent of a coarse crystalline diorite occurring at the Fournier mine, in the township of South Sherbrooke, Lanark County, in the Province of Ontario. Analyses, T. S. Hunt, Geol. Can., 1863, p. 477 : B. J. Harrington, Rep. Geol. Can., 1873-74, p. 198.

188. Ontariolite—A scapolite from the Township of Galway, Peterborough County, Province of Ontario, has been called Ontariolite by C. U. Shepard (Am. Journ. Sci., 3 ser., vol. xx, p. 54, 1880). [The value of an approximate analysis given, is destroyed by the impurity of the material analyzed ; thus far it has no claim to be considered an independent species—Dana, Min., App. iii, p. 106, 1882.]

189. Opal—Common opal or semi-opal is mentioned, by Dr. How, as occurring at a few localities in the Province of Nova Scotia. See also notes to "Cacholong" "Hyalite" (under Addenda), "Tripolite."

190. Orthoclase—This felspar is very abundant among the rocks of the Laurentian system, and well-defined cleavable masses of a reddish, greyish-white or white color, may be obtained in many localities, some of the most important (Laurentian) of which are—the Townships of North Burgess and Elmsley (Lanark Co.), Ross, in large crystals, and Sebastopol, also in very large crystals (Renfrew Co.), in the Province of Ontario—Grenville and Chatham (Argenteuil Co.), and most of the Townships of Ottawa County. Also occurs in veins cutting altered slates in the Townships of Leeds and Inverness (Megantic Co.), and Sutton (Brome Co.), and in the trachytes of Chambly, Brome and Shefford Mountains, and Mount Royal, Province of Quebec. Analyses, T. S. Hunt, Geol. Can., 1863, pp. 475, 476: G. C. Hoffmann, Rep. Geol. Can., 1876-77, pp. 511,512.

191. Pargasite—Finely terminated crystals of dark green pargasite, sometimes an inch in diameter, are found implanted upon, or imbedded in, a greenish-white pyroxene, at the High Falls and at the Ragged Chute, on the Madawaska in the Township of Blythfield, Renfrew County, Province of Ontario. Anal., T. S. Hunt, Geol. Can., 1863, p. 466.

192. Pearl-spar—Is abundant, generally associated with calcite and gypsum, in cavities and geodes in the dolomites of the Niagara formation ; also, in association with calcite, gypsum, barite and quartz, in geodes in the dolomites of the Calciferous formation, and is found in many of the metalliferous veins of Lake Superior and Lake Huron, Province of Ontario—and occasionally in those of the Eastern Townships of the Province of Quebec.

193. Pectolite—Occurs in radiated fibrous aggregations, the fibres being an inch and a quarter and less in length, at Cathcart (now McKellar's) Point, Thunder Bay, Lake Superior, Province of Ontario.

194. Peristerite—The felspar described by Dr. Thompson under this name (in allusion to its beautiful blueish opalescence)—a variety of albite, occurs in large cleavable masses, with quartz, in veins in the Township of Bathurst (Lanark Co.), and in a vein made up of a fine-grained mixture of reddish-white albite and quartz, enclosing large cleavable masses of the opalescent albite, on the north shore of Stoney Lake, near the mouth of Eel Creek, in Burleigh (Peterborough Co.), Province of Ontario. Analysis of a specimen from first-named locality, T. S. Hunt, Geol. Can., 1863, p. 477.

195. Perthite—The Perthite of Dr. Thompson (a flesh-red aventurine felspar, which, as shown by Breithaupt, consists of interlaminated albite and orthoclase) occurs in large cleavable masses, in pegmatite veins cutting Laurentian strata, in the Township of North Burgess, Lanark County. Province of Ontario

196. Petalite—Is here mentioned among the minerals of Canada, upon the authority of Dr. Bigsby, according to whom this mineral was found, with tremolite, in a large boulder on the lake shore, at Toronto, York county, Province of Ontario.

197. Petroleum—The most important oil springs are in the township of Enniskillen, in the western peninsula of Ontario, but it also occurs in other townships of this section of the country, as for instance those of Mosa, Oxford and Dereham. It is found, in small quantity, on Great Manitoulin Island in Lake Huron, Province of Ontario—also on the St. John River, and on a branch of Silver Brook, and other localities in the County of Gaspé, Province of Quebec.

198. Phlogopite—This mineral is of very common occurrence among the crystalline limestones of the Laurentian system, through which it is sometimes more or less abundantly disseminated in the form of small scales or crystals. The largest specimens are generally found in beds near to bands of quartzite or pyroxenic gneiss, which often limit the crystalline limestones, or are interstratified with them. It is also met with imbedded in massive pyroxene rock. Large plates are obtainable in the Townships of Grenville (Argenteuil Co.), Buckingham, Templeton, etc. (Ottawa Co.), in the Province of Quebec—and in the Townships of North and South Burgess, in the Province of Ontario. Anal., T. S. Hunt, Geol. Can., 1863, p 495.

199. Pickeringite—Occurs as an efflorescence on the shale of a sheltered cliff on the banks of the Meander, Newport, Hants County, Province of Nova Scotia. Anal., H. How, Journ. Chem. Soc., new series, vol. 1, p. 200, 1863.

200. Picrolite—This variety of serpentine is met with in the Townships of Bolton (Brome Co.), Shipton (Richmond Co.), etc., in the Province of Quebec. Anal., T. S. Hunt, Geol. Can., 1863, p. 472.

201. Pitchstone—A pitchstone-porphyry, and pitchstone with veins of agate, occurs on the eastern extremity of Michipicoten Island, Lake Superior, Province of Ontario.

202. Platinum, Native,—The earliest reference to the finding of native platinum in Canada, is that by Dr. T. Sterry Hunt (Rep. Geol. Can., 1851-52, p. 120), who mentions having observed it, in association with iridosmine, in the gold washings of the Rivière du Loup and Rivière des Plantes, Beauce County, in the Province of Quebec. It has since been met with, according to Dr. G. M. Dawson (Ann. Rep. Geol. Can., vol. iii, 1887, Part R), in association with placer gold in several localities in the Province of British Columbia—occurring in notable quantity in the region of the Upper Similkameen and Tulameen Rivers, in minute scales where the gold is "fine" but increasing in coarseness to small pellets and nuggets in places where "coarse" gold is found. Coarse grains and pellets have, so far, been found only on Granite, Cedar and Slate Creeks, all entering the Tulameen on the south side. He also mentions its occurrence, in fine scales with gold, on Tranquille River, Kamloops Lake ; at a place ten miles below Lillooet on the Fraser River, and in nearly all the tributaries of the Yukon River which have been worked. Analyses, G. C. Hoffmann, Trans. Roy. Soc. Can., vol. v, sec. iii, p. 17 1887—and an abridged statement of results, Ann. Rep. Geol. Can., vol. ii, p. 5 T, 1886.

203. Polydymite—What is regarded as evidently a ferriferous variety of this mineral is found in association with pyrrhotite, chalcopyrite, some pyrite etc., at the mines of the Canadian Copper Company, Sudbury, District of Nipissing, Province of Ontario. Anal., F. W. Clarke and C. Catlet, Am. Journ, Sci., 3 ser., xxxvii, p. 372, 1889.

204. Prase—A breccia, consisting of angular fragments of prase cemented together with white chalcedony, was found by Dr. G. M. Dawson filling cavities in Tertiary basaltic rocks in mountains at head of Nicoamen River, British Columbia.

205. Prehnite—Occurs chiefly in the trap rocks of Lake Superior, sometimes forming distinct veins, as on Slate River, an affluent of the Kaministiquia and with imbedded nodules of native copper on an island near St. Ignace—Province of Ontario. It has also been found in the Laurentian of the Township of Templeton (Ottawa Co.) in the Province of Quebec. Analyses, E. J. Chapman, Can. Journ., 2 ser., vol. xii, p. 267, 1869 : B. J. Harrington, Rep. Geol. Can., 1877-78, p. 34 G.

206. Pseudomorphous quartz—Fine specimens of quartz pseudomorph after chabazite, have been found at Horse-Shoe Cove, Cape d'Or, and of quartz pseudomorph after stilbite, at Clarke's Head (Cumberland Co.), Province of Nova Scotia. Silicified wood is found in the vicinity of the Elbow of the South Saskatchewan River, and very characteristic specimens of the same at Ross Coulée, Irvine, District of Assinoboia, North-west Territory.

207. Psilomelane—Occurs in association with pyrolusite, at Douglas, Hants County, Province of Nova Scotia.

208. Pyrallolite—Occurs in beds in the crystalline limestone of Grenville (Argenteuil Co.), and Clarendon (Pontiac Co.), in the Province of Quebec—also in the Townships of Ramsay (Lanark Co.), and Rawdon (Hastings Co.), in the Province of Ontario. Analyses, T. S. Hunt, Geol. Can., 1863, p. 471—and of a specimen from Portage du Fort, Township of Clarendon, B. J. Harrington, Rep. Geol Can., 1876-77 p. 484.

209. Pyrite—Is very widely distributed throughout the Dominion. The following are a few of the localities where it is met with in a crystalline form :—in fine crystals at La Have (Lunenburg Co.), and Seven Mile Plain (Hants Co.), in the Province of Nova Scotia—in large cubical crystals in a vein of copper ore in the Township of Melbourne (Richmond Co.), Province of Quebec—in perfect octahedra at Elizabethtown (Leeds Co.), also in a crystalline form in many of the veins and gneissoid rocks of the Townships of Madoc, Elzevir and Tudor (Hastings Co.), and in the trap dykes of Lakes Superior and Huron ; Province of Ontario.

210 Pyrolusite—Is met with near Kentville (King's Co.), at Springville (Pictou Co.), Musquodoboit (Halifax Co.), Onslow (Colchester Co.), near Amherst (Cumberland Co.), and at Walton and other places, especially at Tenny Cape, in Hants County, Province of Nova Scotia. This mineral also occurs at several places in the Counties of Westmoreland, Albert, St. John and King's,—the most important deposit being at Markhamville, in the parish of Upham, King's County,—in the Province of New Brunswick.

211. Pyroxene—Is of common occurrence especially among the rocks of the Laurentian system, where it not unfrequently forms beds, or large segregated veins, which sometimes consist of pure pyroxene, at other times of pyroxene in admixture with other minerals, constituting pyroxenite. It also sometimes occurs disseminated in beds of magnetic and, in the form of grains and imperfect crystals, it is common in the beds of limestone. Among the numerous localities of its occurrence may be mentioned :—Kildare. (Joliette Co.), the Townships of Argenteuil and Grenville (Argenteuil Co.), Buckingham, Templeton, Portland, Wakefield, and adjoining Townships (in Ottawa Co.), and Litchfield (Pontiac Co.), in the Province of Quebec. The Townships of North Elmsley and North Burgess (Lanark Co.), and elsewhere in this part of the Province of Ontario. Very large crystals of pyroxene are not unfrequently met with in the above referred to Townships of Templeton, Portland, and Wakefield, as also in the Townships of Sebastopol and Blythfield (Renfrew Co.), in the Province of Ontario—and a very handsome lilac-colored pyroxene occurs in the Augmentation of the aforementioned Township of Grenville. See also notes to "Augite," "Coccolite," "Diallage," "Fassaite," "Malacolite," "Sahlite."

212. Pyrrhotite—Occurs in many localities ; among which may be mentioned the Townships of Barford (Stanstead Co.) Sutton and Bolton (Brome Co.) where it is associated with copper ores ; St. François (Beauce Co.) associated with pyrite, arsenopyrite, etc., and St. Jérôme (Terrebonne Co.) associated with pyrite—in the Province of Quebec. Abundantly, more or less associated with chalcopyrite, in McKim and adjoining townships (District of Nipissing) ; accompanying pyrite in Elizabethtown (Leeds Co.), at Balsam Lake (Peterborough Co.), Province of Ontario. A very interesting twin crystal found by Dr. Harrington at the Elizabethtown deposit (Anal., B. J. Harrington, Rep. Geol. Can., 1874-75, p. 304), was examined by Dr. E. S. Dana, Am. Journ. Sci., vol. xi, p. 386, 1876.

213. Retinalite—Is found, imbedded in crystalline limestone, in the Township of Grenville (Argenteuil Co.), and on Calumet Island (Pontiac Co.), in the Province of Quebec. Analyses, T. S. Hunt, Geol. Can., 1863, p. 471.

214. Rhodochrosite—Has not, as yet, been found in Canada in distinct examples, but occurs in admixture with many of the manganese ochres, and is also present, in traces, in some of the altered strata of the Eastern Townships of the Province of Quebec.

215. Ripidolite—Has, so far, not been indentified with certainty as occurring in Canada. A chloritic mineral occurring—in uneven folia, of an olive-green color and pearly lustre—in association with apatite, quartz, pyrite and calcite, in the Township of Templeton (Ottawa Co.), Province of Quebec, has been examined by Dr. Harrington (Rep. Geol. Can., 1877-78, p. 34 G), and found to have, approximately, the composition of ripidolite. A foliaceous mineral found in a serpentine rock in the adjoining Township of Buckingham would, so far as it has yet been examined, also appear to be referable to this species.

216. Rock Crystal—Is found, in large crystals, at South River (Antigonish Co.): in perfect crystals at Spencer's Island (Cumberland Co.): at Sandy and Mink Coves (Digby Co.), etc., in the Province of Nova Scotia. In crystals (known as Quebec diamonds) showing unusual modifications in form, in fissures and cavities in limestone rocks in the vicinity of Quebec, and in large transparent crystals, in quartz veins, at Harvey Hill mine (Leeds Co.), Province of Quebec. Also in good crystals in cavities of the quartz veins of the Bruce mines, Lake Huron, and similar veins at Thunder Bay, Lake Superior, Province of Ontario.

217. Rosequartz—Is found at Westfield (Queen's Co.) and, in the form of pebbles, near the town of Shelburne (Shelburne Co.), in the Province of Nova Scotia.

218. Rutile—Occurs, in the form of needles in quartz, at Scot's Bay (King's Co.), Province of Nova Scotia. In small orange-red grains in the ilmenite of St. Urbain, Bay St. Paul (Charlevoix Co.); in small red flattened crystals in the chloritic schists of the township of Sutton (Brome Co.) ; in minute grains in the black sand obtained in the washing of the auriferous gravel at Rivière du Loup (Beauce Co.), and in somewhat large crystals, occasionally geniculated, in a gangue of dolomite and barite, in the Towhship of Templeton (Ottawa Co.), Province of Quebec. It has been found in tolerably distinct crystals in crystalline limestone on Green Island in Moira Lake, in the township of Madoc (Hastings Co.), and in the form of delicate acicular crystals, in quartz cavities at the Wallace mine, Lake Huron, Province of Ontario. See also note to "Sagenite."

219. Sagenite—A transparent quartz penetrated with needles of rutile is stated, by Prof. How, to have been found at Scot's Bay, King's County, Province of Nova Scotia.

220. Sahlite—The most common variety of pyroxene met with in the apatite deposits of Ottawa County,

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* Paper read before the Royal Society of Canada.

Province of Quebec, would appear to be a lime-magnesia-iron pyroxene or sahlite. On peculiarities in forms of crystals from this locality, see results of observations by B. J. Harrington, Rep. Geol. Can., 1877-78, p. 18 G.

221. Sal-ammoniac—Has been met with, in association with native sulphur, constituting a deposit on the cliffs of shale on Smoky River, North-west Territory. Anal., G. C. Hoffmann, Rep. Geol. Can., 1875-76, p. 420.

222. Samarskite—Has been found on lots one and two of the second range of Maisonneuve, Berthier County, Province of Quebec. [When first met with, this township was not laid out, consequently the locality could not be given more definitely than as it appears in the report, here referred to, viz., just beyond the north-western limits of Brassard (the adjoining township), Berthier Co.]. Anal., G. C. Hoffmann, Rep. Geol. Can., 1880-82, p. I II.

223. Saponite—Occurs in cavities in the trap of St. George or Hog Island, Richmond Bay, north coast of Prince Edward Island. Anal., B. J. Harrington, Can. Nat., 2 ser., vol. vii, p. 179, 1875.

224. Selenite—Is met with in greater or less quantity at several of the gypsum deposits in the Province of Nova Scotia, as at Oxford, River Philip (Cumberland Co.). In the Province of New Brunswick it is especially abundant at Petitcodiac (Westmoreland Co.) where the gypsum deposit, which has a breadth of about forty rods and a total length of about one mile, is traversed through its entire extent by a vein of nearly pure selenite eight feet wide. This mineral is also met with in the Provinces of Quebec, Ontario, Manitoba and elsewhere.

225. Senarmontite—Occurs, with native antimony, stibnite, valentinite and kermesite, in veins traversing argillite in the township of Ham, Wolfe County, Province of Quebec.

226. Serpentine—Is met with abundantly among the metamorphic rocks of the Eastern Townships and Gaspé peninsula, in the Province of Quebec, where it forms vast masses, which are frequently almost free from other admixture, but at times enclose diallage, actinolite, garnet and chromite; or are intermixed with carbonate of lime, dolomite and occasionally ferruginous magnesite. Extensive beds, mostly containing intermixed carbonate of lime and dolomite, occur in the townships of Thetford and Coleraine (Megantic Co.), Broughton (Beauce Co.), South Ham and Garthby (Wolfe Co.), Melbourne (Richmond Co.), Orford (Sherbrooke Co.), and Bolton (Brome Co.); around Mount Albert in the Shickshock Mountains, and at Mount Serpentine near Gaspé Bay, in Gaspé County. Among the massive and nearly pure Laurentian serpentines may be mentioned those of the townships of Grenville (Argenteuil Co.), in above named Province—and North Burgess (Lanark Co.), in the Province of Ontario. See also notes to "Chrysotile," "Picrolite" and "Retinalite." Analyses, T. S. Hunt, Geol. Can., 1863, p. 472.

227. Seybertite—Is mentioned by Dr. Hunt, as occurring, with small crystals of blue spinel, in a crystalline limestone in the seigriory of Daillebout, Joliette County, Province of Quebec.

228. Siderite—A bed of spathic iron, varying in thickness from six to ten feet, occurs in sandstones of the Millstone-grit formation, near Sutherland's River, Pictou County, Province of Nova Scotia. Occurs in thin veins in Huronian rocks in the Nerepis valley, and is also diffused to a considerable extent through rocks of Devonian age in the northern part of Charlotte County, in the Province of New Brunswick. Is found in quantity, in beds, on Flint, Davieu's, and other islands of the Nastapoka group, eastern coast of Hudson Bay—and is also met with in quantity in the township of McIntyre, Thunder Bay, Lake Superior, Province of Ontario. See also notes to "Clay iron-stone," "Sideroplesite." Analyses, Gordon Broome, Rep. Geol. Can., 1866-69, p. 442: B. J. Harrington, ib., 1877-78, p. 47 G.

229. Sideroplesite—Occurs in the ankerite deposits of Londonderry, Colchester County, Province of Nova Scotia. Anal., H. Louis, Trans. N. S. Inst., vol. v, p. 50, 1879-82.

230. Silicified wood—See note to "Pseudomorphous quartz."

231. Silver. Native,—Nuggets and grains of native silver have been found in washing for gold in a great many parts of British Columbia, the largest being obtained in the Omenica district. It also occurs, in association with argentite, at the various mines enumerated in the note to "Argentite."

232. Smaltite—Has been met with in the form of minute crystals, in association with chalcopyrite, in the Township of McKim, District of Nipissing, Province of Ontario. Ann. Rep. Geol. Can., vol. ii, p. 11 T., 1886.

233. Smoky quartz, Cairngorm stone—Is met with in several localities in the Province of Nova Scotia, amongst the most noted being Paradise River and the neighborhood of Bridgetown and Laurencetown in Annapolis County; is also found at Mud Village (Lunenburg Co.), at Margaret's Bay (Halifax Co.), and of very dark color at Little River, about five miles from Halfiax.

234. Soapstone—See note to "Talc,"

235. Sodalite—Occurs in the nepheline-syenites of Brome (Brome Co.), Montreal (Hochelaga Co.), and Belœil (Rouville Co.), in the Province of Quebec. A very beautiful blue sodalite, in large specimens, has been found by Dr. G. M. Dawson, in abundance, in the vicinity of Ice River, a tributary of the Beaver-foot, in the Rocky Mountains, Province of British Columbia. Anal., B. J. Harrington, Trans. Roy. Soc. Can., vol. iv, sec. iii, p. 81, 1886.

236. Specular-iron—Amongst other localities, is met with in tabular crystals at Sandy Cove, Digby Neck (Digby Co.), Province of Nova Scotia: in tabular crystals, or thick plates, in the Township of Leeds (Megantic Co.), also in thick plates in the Township of Shefford (Shefford Co.), in the Province of Quebec.

237. Sperrylite—This recently discovered and highly interesting mineral, arsenide of platinum, was found at the Vermilion mine, Township of Denison, District of Algoma, Province of Ontario. Anal., H. L. Wells, Am. Journ. Sci., 3 ser., vol. xxxvii, p. 67, 1889: on the crystalline form of Sperrylite, S. L. Penfield, ibid, p. 71.

238. Spessartite—Is found, together with black tourmaline, uraninite, monazite, etc., in a coarse pegmatite vein—composed of microcline, albite, muscovite and white and smoky-brown quartz—in the Township of Villeneuve, Ottawa County, Province of Quebec.

239. Sphaerostilbite—Has been met with by Prof. How, at Hall's Harbor, King's County, Province of Nova Scotia.

240. Sphalerite—Is somewhat widely distributed, being found, but most frequently in small quantities only, in all the Provinces of the Dominion. It is met with, in greater or less abundance, in almost every metalliferous vein which has been opened on the east and north shores of Lake Superior, and an important deposit of the same is situate some eleven miles north-east of Rossport (formerly McKay's Harbor) on the north shore of that lake, Province of Ontario. Also occurs in quantity in the Township of Calumet—where it is associated with more or less galenite and a little pyrite,—Pontiac County, in the Province of Quebec.

241 Spinel—Small translucent octahedrons of blue spinel are found in a bed of crystalline limestone in the seigniory of Daillebout (Joliette Co.), in the Province of Quebec. Large and not unfrequently very symmetrical black crystals, sometimes an inch or even two inches in diameter, occur in crystallized limestone in Burgess (Lanark Co.), and similar crystals, though less perfect, are found, together with fluorite, apatite and crystals of white orthoclase, in a vein of flesh-red calcite in the Township of Ross, Renfrew County, Province of Ontario.

242. Spodumene—Is said, by Dr. Hunt, to have been observed in a small rolled mass of granite near Perth, Lanark County, in the Province of Ontario.

243. Staurolite—Occurs in mica-schists of Moore's Lake, Charlotte County, Province of New Brunswick.

244. Steatite—See note to "Talc."

245. Steeleite—Is found imbedded in red clay in cavities in Triassac trap, at Cape Split, thirteen miles west of Cape Blomidon, King's County, Province of Nova Scotia.

246. Stellarite—The name given by Prof. How to the so-called "stellar" or "oil-coal," which occurs with bituminous coal (in a seam five feet thick, of which one foot ten inches are stellarite) at the Acadia mines on the Acadia Coal Company's area, Pictou County, Province of Nova Scotia. Analyses, H. How, Min. N. S., p. 24, 1869. Sir William Dawson, referring to this substance (Acadian Geology, 3rd ed., 1878, p. 339) says:—"The material known as stellar-coal is, as I have maintained in previous publications, of the nature of an earthy bitumen; and, geologically is to be regarded as an underclay or fossil soil, extremely rich in bituminous matter, derived from decayed and comminuted vegetable substances. It is, in short, a fossil swamp muck or mud which, as I have elsewhere pointed out, is the character of the earthy bitumens and highly bituminous shales of the Coal formation generally."

247. Stibnite—An important deposit of this mineral exists in the parish of Prince William (York Co.), in the Province of New Brunswick, where it is contained in numerous large and well-defined veins of quartz, filling lines of dislocation in highly tilted argillaceous slates and quartzites: also at Rawdon—where, in association with a little quartz and calcite, it constitutes a vein cutting talcose slates,—and West Gore, Hants County, Province of Nova Scotia. It is found in small radiating prismatic crystallizations, with native antimony, valentinite, senarmontite and kermesite, in veins in argillite, in the Townships of South Ham (Wolfe Co.), Province of Quebec. It has been met with in small quantities, in association with pyrite and mica, in a band of crystalline dolomite in the Township of Sheffield (Addington Co.), and in small masses mixed with tremolite, under similar conditions, in the Township of Marmora (Hastings Co.), Province of Ontario—also occurs near Foster's Bar, about twenty-three miles from Lytton, Fraser River, Province of British Columbia.

248. Stilbite—Is abundant, and exhibits a large number of crystallized varieties, often of great beauty, at Partridge Island (Cumberland Co.), Hall's Harbor and Morden (King's Co.), and Margaretville (Annapolis Co.), in the Province of Nova Scotia. Anal., H. How, Phil. Mag., 5 ser., vol. i, p. 134, 1876.

249. Strontian—Occurs, in the form of white fibrous tufts, in cracks in concretionary limestone masses in the Utica slate of St. Helen's Island, Montreal, Province of Quebec. Anal., B. J. Harrington, Trans. Roy. Soc. Can., vol. i, sec. iii., p. 81, 1882-83.

250. Sulphatite—The water of the so-called Sour Spring of Tuscarora (Brant Co.), as also that of a spring in the south-west corner of Niagara, and of one at St. David's, in the same Township (Lincoln Co.), and of another about a mile and a-half above Chippewa (Welland Co.), in the Province of Ontario, are all remarkable for containing a large proportion of free sulphuric acid. Analyses, T. S. Hunt, Geol. Can., 1863, pp. 540, 545.

(To be continued),

MINING NOTES.

Nova Scotia.

From our own Correspondent.)

Waverley District.

The management of the Lake View Mining Co. closed down its stamp mill about the middle of this month (January) and have begun the work of tearing out the batteries and foundations. The mill has been in commission less than four months. This is the twenty stamp mill that was completed in September last, at a cost reported to exceed $16,000, and was publicly announced to be the finest ever built in Nova Scotia. Three of the mortars were of Fraser & Chalmer's latest and best pattern, and the fourth was of exact Homestake pattern, but cast in Truro, N.S. Mention was made of this mill and its vibration in the November issue of the Review. The reason given by Supt. Hayward for the changes to be made is that the western pattern mortars "will not save the gold" but it is rumored that there are other reasons. The superintendent also announces that the mine will close down on the 1st of February.

The Chebucto mine, known as the Gue and Wilson, has been transferred to a company organized under the laws of Nova Scotia and named "The West Waverley Gold Co., Ltd." Mr. J. E. Hardman, of Oldham mines, has been appointed manager. Work will begin this month in the mines, and will be pushed as fast as is consistent with economy and permanent advantage. Mr. R. L. Sherman is the mining captain.

Renfrew District.

The Free Claim mine has been permanently closed down by its owners; the pumps having been taken out the first week in January. It is understood that the mine has not been paying for some time.

The Empress Co., have rebuilt their engine house and shaft house destroyed by fire in August and are again at work in this shaft.

The cold weather has seriously interfered with the reclaiming of the old Ophir mine, the power being derived from water and transmitted a long distance. The attempt will be abandoned until spring.

Montagu District.

Work in this district continues with little new to report. The Rose lode has not come up to anticipations and will not produce much for some time to come. The DeWolfe lode is still working with average results.

Oldham District.

The new mill of the Oldham Gold Co., is approaching completion and will be ready to go into commission in February. The mines of this company are still in very low grade ore, and the large developments made have as yet failed to disclose high grade quartz.

The Standard Gold Co., will complete their new plant of pumping machinery and air compressor in February. The new hoist has been in commission now for three months and has given great satisfaction.

South Uniacke District.

The Witherow mine has secured the services of Alexander Cameron as mining captain, and have had better ore for some time past. The mine looks better to-day than for six months. It is intended to extend operations as soon as spring opens.

Killag District.

Manager MacKay of this district reports the first week's clean up at 57 ounces. Winter has somewhat retarded operations here, but work is going ahead as fast as possible.

Malaga District.

The mill of the Boston Gold Mining Company was started the week before Christmas. It is a very complete ten-stamp mill, built and equipped by the Truro Foundry and Machine Co. It is furnished with the Hammond roller ore feeder, which is reported to work perfectly. The mortar and details are modelled upon the "Homestake" pattern, and the mill as a whole is said to be the best one in the district. The quartz is said to mill from $16 to $36 per ton.

The mine, mill and plant of the Minneapolis and Malaga Mining Co. were sold at sheriff's sale on the 9th instant for the sum of $13,000 to Mr. McLean, acting for Douglass et al. of Philadelphia.

Stormont District.

This district has little to report, the protracted litigation over the surface rights in Hurricane Island acting to prevent work by either party.

On the west side the North Star Company have been developing their property. The main incline on the North Star lode has been sunk over 70 feet and drifting on the lode will soon begin.

Work has also been doing on the Burke lode by the same company.

Cape Breton.

The quantity of coke manufactured at the works of the Gowrie Coal Company at Cow Bay during 1890, amounted to 3,550 tons.

Caribou District.

The Caffrey property is closed down.

There is little to report from this district. The year's returns from the once famous lake lode are microscopic. Some little work is yet doing there, but to little purpose.

The Truro Gold Mining Co., have entrusted Mr. E. Whidden, with the management of their property. Mr. Whidden is also managing the Halifax Prospecting Co's work in this district.

The Dixon property is working steadily and is almost the only producing lode in the district.

The excitement over the auriferous conglomerates running from Brookfield to Lansdowne, in Colchester County has somewhat abated. Mill tests and assays have shown yields ranging from 58c. to $4.30 per ton, but the lack of any regularity in the gold contents of the conglomerate will necessarily act as a deterrent to capitalists asked to buy these properties at extravagantly high prices. It is probable the coming summer will see some private efforts to thoroughly prospect these auriferous belts.

Quebec.

Eastern Townships.

The total output of copper pyrites from the Capelton mines of the Eustis Mining Company amounted to 27,000 tons.

Returns from the Anglo-Canadian Asbestos Company show a product for 1890 of 11,194 tons of all grades, of which 1,167 tons were exported.

In connection with the copper trade, we notice that the well known firm of Messrs. Thos. Robertson & Co. have been appointed agents for the sale of the Orford Company's products and will hereafter keep a stock of this fine Canadian copper.

The following figures have been received from the American Asbestos Company at Black Lake :

	Output.	Exports.
Extra Quality	$398\frac{19}{20}$	$352\frac{6}{20}$
Run of Mine	$661\frac{3}{20}$	$430\frac{8}{20}$
Waste	$35\frac{1}{20}$	5
Total	$1,095\frac{3}{20}$	$787\frac{14}{20}$

The following are the exports from the Thetford Mining Company :

No. I quality	36 tons.
No. II do	20 do
No. III do	14 do
Waste	10 do

All shipped to Hamburg.

The quantity raised from Mr. A. H. Murphy's lot at Black Lake, included :

No. I quality	7½ tons.
No. II do	9 do
No. III do	32½ do

Ottawa Valley.

Considerable activity is manifest in phosphate operations in the Templeton district. Among other properties now at work are those of the East Templeton District Phosphate Mining Syndicate, the MacLaurin Phosphate Mining Syndicate, the North American Company and other properties being worked under the energetic management of Messrs. Lomer, Rohr & Co. Of these the most promising producer is unquestionably that of the old Blackburn mine, from which Mr. Lomer is confident of making an output this year of close upon 5,000 tons of good quality.

The property of the North American Company, being worked on royalty, yielded last month 1,000 tons from five men, in six weeks—an excellent showing. The old Jackson Rae property has been opened up and is now worked by Mr. Thos. Fee of Ottawa. Satisfactory reports are also received from the McRae lots, which have been equipped with an excellent Ingersoll plant.

Messrs. S. H. Thompson and Mr. J. W. Agret are also doing well on their properties. Altogether the output from the Templeton district should exceed previous records.

In addition to the figures reported in last month's REVIEW, 500 tons were shipped from the Lievres district for use at the Capelton Chemical and Fertilizer Works.

The dumps of the old Emerald mine seemed to have proved a lucrative investment, for it is reported that fully 1,000 tons were extracted therefrom by Lomer, Rohr & Co.

Owing to the greater portion of the year being taken up with the construction of roads, the erection of buildings, installation of plant and other necessary preliminary operations, the output from the Ætna and Squaw Hill mines operated by the Anglo-Continental Guano Works Company of Hamburg and London, has not been as large as was expected. The shipments for 1890 will figure close upon 1,000 tons.

Ontario.

Kingston District.

The Canada Company have lately given a new license for ten years to James Bell, of Arnprior, of the Rock Lake Phosphate mine—Lot 21, in 15th concession Storrington. Mr. Bell agrees to raise 100 tons per month for the rest of the time. It is understood that Lomer, Rohr & Co., of Montreal, are in with Mr. Bell, and work is to be carried on vigorously with the best machinery. Operations were resumed about the 15th instant, and the probabilities are that the output will be much larger than the minimum quantity called for by the license.

Manitoba and North-West Territories.

The output of coal from the new works of the Canada North-West Coal and Lumber Syndicate, at Canmore, amounted to about 5,000 tons. A great deal of preliminary work has been done and the mines are now well equipped and in a position to yield a good monthly output.

British Columbia.

The yield of gold from the placer mines for the last year does not equal that of 1889, chiefly due to the fact that the mines of the Cariboo district have gone behind by over $50,000. No new mining grounds have been discovered, although it is believed by old miners that such may yet be discovered by careful search. The present year will see extensive work in the hydraulic mines of the Quesnelle River, where successful mining has been carried on for many years.

Vancouver Island.

There has been a steady demand for British Columbia coal throughout the last twelve months. The chief market was, as usual, San Francisco, but orders from other points were received and filled, amounting to a respectable quantity, and besides this the shipping demand was very large, while a good deal was taken for local uses. The supply was chiefly derived from the mines of the New Vancouver Company, as owing to the unfortunate strike at Wellington, the mines which have been operated there were rendered comparatively unproductive. Although the strike is entirely over, these mines have not yet secured their full complement of men, and only a limited quantity is produced. Meanwhile the New Vancouver company has materially increased its facilities by the sinking of new shafts and the employment of many additional men, so as to enable it to meet the requirements. The Union mines have turned out a fair quantity of coal, but the production was restricted by the seam turning out to be faulty. Recent boring, however, has discovered a valuable eight foot seam, and they are not likely to be further hampered from this cause. The East Wellington pits have produced a good quantity also. There has been a good deal of prospecting at Fort Rupert, Quatsilo and Tumbo Island, resulting in the discovery of immense deposits, the extent of which cannot be definitely conjectured.

Following are the returns of coal entered for foreign shipment at the Nanaimo, B.C., Custom House :—

	Tons.
New Vancouver Coal Company	289,359
Wellington Coal Company	103,977
East Wellington Coal Company	36,445
Union Coal Company	58,393
Total foreign shipments, 1890	488,174

This, estimated at a value of $4 per ton, will make the value of coal exported to foreign countries $1,952,696. The returns of the domestic trade are not yet to hand, but are estimated to amount to, at least, 125,000 tons, which, at the same price, is worth $500,000, and the total coal sales in round numbers may be set down as 614,000 tons, of the value of $2,500,000. This does not include coal at the mines on January 1, 1891.

The total outputs of coal for the five years, 1885 to 1889, were :—

	Tons.
1885	365,000
1886	326,636
1887	413,360
1888	489,300
1889	579,830

The coal sales of 1890, therefore, may be estimated to exceed the total output of 1889 by, in round numbers, 35,000 tons.

A falling off of over $76,000 is reported in the shipment of gold dust from Victoria in 1890 as compared with 1889, partly due to the fact that other channels are now used to send the gold out of the country and also to the decreased output of the Cariboo mines, which have fallen $50,000 behind the previous year. Following were the respective shipments : Bank of British Columbia, $204,291.26 ; Bank of British North America, $23,999.12 ; Wells, Fargo & Co., (Garesche, Green & Co., agents), $183,587.61 ; total shipments, 1890, $411,877.99 ; total shipments in 1889, $488,193.62 ; decrease in 1890, $76,315.63.

Lillooet.

Mining here is yet in its infancy, and very little has been done, comparatively speaking, to develop the resources of this district. Prospecting along Cayoosh Creek has discovered several paying lodes, but there is a lack of capital to work them. The placer mines yield well, considering the number of men engaged, for Lillooet and vicinity the product being about $40,000.

The Deadwood mine, on the Fraser River, below the Cayoosh Creek, has closed down after a successful season's work by the hydraulic process. The company have a high bank of pay gravel, gold being found from top to bottom. Next year they intend to bring in more water, whereby their power will be greatly increased.

The Great North American Company has done well, considering that they have but twenty-five inches of water, and have taken out more gold in proportion than any other company in the district. They cleaned up $2,000 for the season, or an average of $5 per day to the hand. Their ledge extends one mile.

The Vancouver Enterprise Company are pushing their tunnel to completion, and expect to have it through next spring. They have expended some $12,000 so far, but it is believed they will do well when they begin actual operations.

The Lillooet Hydraulic Company, have also had a successful season, their mines having yielded between $5,000 and $6,000 during that time. The company intend putting in iron pipes and a monitor and enlarging their flumes and ditch. They have also a valuable property on the South Fork of the Bridge river, where they have succeeded in turning the river from its bed for half a mile. Owing to the lateness of the season no sluicing was done, but a few holes were sunk to bed rock in which good prospects were found.

Yale.

Mining matters have not been booming in this section, but still a fair amount has been done and the prospects for this year are encouraging. Thirty-six locations were recorded in 1890.

The Fraser River Gold Gravel Syndicate were unable to do much last season, owing to the unfortunate loss of their raft with the boiler to run their plant. In the coming season, however, work will be resumed and actively prosecuted. Another boiler is on its way out. This syndicate, which is very wealthy, possesses mines in Africa, Mexico, Norway, Spain and other countries, and should their property here prove a good one, there will be plenty of capital to develop other claims.

The Fraser River Dredging Company will commence operations next spring with a steam dredging apparatus worth $30,000.

The Anglo-American Mining Company, which was not incorporated until late in the season, has a lease of 4½ miles of Siwash Creek, with an average breadth of 10,000 feet. The prospects are good, and there is reason to believe that if work is carried on vigorously next spring, the results will be good.

The Queen mine (silver) has been worked all summer, and operations are being continued throughout the winter, sinking a shaft on the course of the lode. The indications are that when further developments have been made, there will be a good record. When the quantities of ore are sufficient there will be ample means forthcoming for the erection of all necessary appliances for treating it. From its situation, the Queen is considered one of the best mining properties of the Province. It is expected that on account of the good prospects obtained on the Creek, the companies having claims there will expend a good deal of capital there during the coming season.

Cariboo.

While the gold yield of Cariboo this year has been somewhat less than last, yet the discoveries and developments made exceed in importance those of many years past. In the Barkerville division the Forest, Taylor and Black Jack hydraulic companies have paid fairly well. The Waverley Hydraulic Co., on Grouse Creek, have not yet reached bedrock with their cut, but their annual production of gold increases. The Jarvis Co., who struck such a rich lead last year, got off pay during the winter, and are now drifting in search of the best channel in the hill. Considerable prospecting has been done on Lightning Creek, in some instances with success.

The Black Jack Quartz Mining Company have prosecuted the development of their mine throughout the season. Their shaft is down over 100 feet, and they are still sinking. A very good body of ore was struck at the 64 foot level, the whole width of the drive being a solid mass of sulphurets, and this decided the shareholders to continue the work of development themselves, instead of carrying out their previous intention of placing a portion of the capital stock upon the market to be sold for a working capital. As soon as circumstances warrant, a larger stamp mill will be erected, and it is hoped that next season will see the industry assume a permanent shape. A very satisfactory test of ore from this mine was made in Glasgow recently. From 360 pounds of ore sent, a result of $86 per ton was obtained by the process of treating the ore pursued, which worked up to 90 per cent. of the assay value.

The Island Mountain Company's mill, which was at work crushing during the season, has closed down, but is expected to start again shortly. The sulphurets from this company and the Black Jack are being roasted and chlorinated at the Government test works, and the results will shortly be made known.

The Mines at Forks of Quesnelle, in this district, are reported to be doing well. Owing to the wet summer there was an unusually good supply of water during the whole season, which enabled the miners to work to good advantage, and although the mining population, chiefly Chinese, has decreased, yet the yield of gold has been quite up to the average. From the present outlook it is likely that some very good hydraulic mines will be opened before long in this section. A number of companies are engaged in making ditches and otherwise preparing to open up an old channel of the South Fork River, which promises valuable mines of this class, while on Keithly and Snowshoe Creeks, several claims are in full working order.

On Spanish Creek a company has been prospecting for the last twelve months. They have not struck anything very much yet, but have a small prospect and have not yet got to the bottom. They are driving in a tunnel. Two other parties are also prospecting in this vicinity.

The estimated amount of gold taken out of this district last season is $62,800. Of this amount $45,300 is from the Keithly division and $17,500 from the Fraser River in the Alexander and Williams Lake polling divisions. The average number of white men employed was about forty, and two hundred Chinamen.

Kootenay District.

The past year has been eventful in this district, the development of old claims having been carried on vigorously while new locations, some of great richness, have been discovered. The commencement of construction work on the Columbia and Kootenay railway and the prospect of an extension of the N. P. R. R. across the boundary into the Kootenay Lake district, together with the establishment of steamboat lines connecting with existing lines of railway, have done much to inspire confidence in the future of this part of the country. The completion of the smelting works at Revelstoke and the reaching out and bidding by that company for the ores of the district has also tended to give a good impression of the possibilities of the district, and in the current year, everything points to a remarkable development and an output of mineral that will far exceed any previously done. The total yield of gold in the West Kootenay district for the year 1890, including quartz with the placer yield, is $35,000, an increase of $5,000 over 1889. This is a remarkably good showing when it is remembered that the Big Bend district is this year thousands behind the yield of 1889.

There is a promising group of claims about three miles west of Nelson, assays from the ore taken out showing good paying qualities.

There has been some prospecting in the Lardeau Pass and five locations have been recorded. The assays are good.

A nickel deposit has been discovered on the west bank of the Kootenay. Assays return 30 per cent. of nickel, but the average would probably be 12½ to 15 per cent.

In Illicillewaet considerable development work has been done, and some of the claims are turning out well.

At Albert Canon, a few miles away, the Wild Fox is located. On this claim is a tunnel 47 feet. The vein matter is galena, 3 feet wide, with an assay value of 22 oz. of silver and 47 per cent. lead per ton. There are two other locations here on which assessment work has been done, the ore being of the same character as the Wild Fox.

In the Poorman mine at Eagle Creek, owned by Davenport and Harvey, the company are sloping from the 90 foot level. The upper tunnel is already in 100 feet and will be extended until the ledge is struck, another 400 feet, and beyond to the White Ledge, owned by the same company. A ten stamp mill is in operation, and about 1,200 tons of ore were milled last season, working about three months. The returns are private.

The Catamount, some two miles away, exhibits a large deposit of ore. A cut across the vein extended 16 feet without encountering the foot wall. The vein matter is in quartz, impregnated with sulphurets existing in a hornblende formation; the returns average from $15 to $30 per ton, gold. A tunnel is being run at a lower level, a distance of 115 feet. There are besides, the Wild Cat and Forrest, of similar kind. Further down there are other locations, the ore from which assays from $16 to $40 per ton.

About a mile from these latter is the Royal Canadian, on which claim there are two tunnels, each 90 feet. The ledge is 2½ feet wide, and the ore reported to be worth $30 per ton by the owners. An offer has been made by Australian capitalists to put up a mill and pay $15,000 for a half interest, provided the ore assayed $20 per ton.

Five localities exist on Rover Creek. On one, the White Water, a tunnel is in 90 feet and will, when completed, intersect the vein, 120 feet from the surface. The ledge is six feet wide and contains excellent high grade gold ore. The average of fifteen samples assayed gave a return of $80.17 in gold. One and a half tons were sampled at the Revelstoke works, and $110 in gold and 9 oz. of silver were obtained therefrom. It is the intention of one of the owners to remove two mills now on the Cottonwood Creek to a site in the vicinity of these mines.

The camp at Hot Springs has kept some 125 men mining steadily all summer, besides 200 others at outside work and prospecting.

The Skyline has a 130 foot incline on the vein. The shipments the year before last were 15 tons of 325 ounce ore; last year, 95 tons of 280 ounce ore were sent out, and there are now 1,000 tons of 45 ounce ore on the dump. A new double shaft has been started, an engine and pump set up, and a fine shaft house 70 x 31 completed. Work on 200 feet of contract sinking has also been begun.

The United is down sixty-feet, all in ore, and will have 1,000 tons ready for shipment on completion of the railroad. They will sink 200 feet more this winter. The steam works are nearly completed.

Over 1,000 tons taken from the Krao are ready for shipment on the coming of cheap transportation. They are down 70 feet and have a steam hoist pump nearly ready for operation.

At No. 1 the vein has been struck within 15 feet of the bottom of the old shaft. The ore is of high grade and averages nearly 4 feet of solid mineral. This will help the camp greatly, as hitherto No. 1 was the only claim that could be pointed out as likely to be a failure, while now it is among the best. The vein will be tapped near the tunnel and a large extent of ground prepared for sloping. Here also some 2,000 tons of ore are awaiting the coming of the railway, together with 50 tons of high grade assorted ore.

The Crescent and Eden, Tenderfoot, Vancouver, Old Timer and Neosho, have all struck new bodies of high grade ore carrying native silver, recently, and are taking it out and sacking it.

There has been more development of the surrounding region of late, while within the Hot Springs and Hendryx camps it has also amounted to a good total, that may be summed up as follows: The Blue Bell has 1,500 ft. of tunnel and drifts; No. 1, 1,200; Skyline, 490; Gallagher, 220; Krao, 350; Donald, 250; Spokane, 350; Maestro, 260; Dictator, 200: Highland, 150; Pataha, 120; Fourth, 100; and many others have between 25 and 75 feet.

Perhaps the most important camp formed in 1890 was the one at Trail Creek, which, moreover, gives promise of permanency and value. It is situated on the west side of the Columbia River, 18 or 20 miles from Sproate's Landing. The first find was made a year ago last summer, when a gold lead and silver proposition was discovered on the surface, the gold running into silver as depth was reached. At a depth of 25 feet an assay of $125 of silver has been obtained. The tunnel is in 30 feet with a 3 foot vein of galena ore. Between 50 and 100 claims have been recorded in the past year.

The Le Roi has a vein 25 feet in width with 15 feet of ore, and 7 feet of copper. The highest assay from this claim shows $5.00 per ton. Recently capital has been induced to take hold of the Le Roi claim, and a company has been formed known as the Le Roi Mining Company, with a capital $150,000. Enough stock has been paid in to enable the company to work three shifts during the winter, and the manager expects to sink 100 feet and drift another hundred by the time navigation opens in the spring.

Other claims also show very well and give indications of large returns. Several reports have been made, all of them favorable upon the district.

There is not a great deal to report on Toad Mountain beyond that assessment work has been done on the several claims. The tunnel on the Silver King is in over 300 feet and some 150 feet has yet to be run before the bottom of the incline shaft is reached. The Grizzly, a spur of the Silver King, is developed by a 65 foot shaft, and 72 oz. of silver per ton was got from an assay of an average sample of ore taken from this mine. The Iroquois is a parallel claim to the Silver King and shows a good body of ore. In addition to the locations above mentioned, there is also the Water Jacket, Toughnut, Jonah, Morning, Evening and Pacific, in all of which more or less development work has been done. The ore from the latter locations is low grade. The Toughnut shows a well-defined vein, varying in width from six to fourteen feet. The ore from this claim is of a refractory nature on account of the zinc carried, but the percentage of copper, silver and lead is high enough to make it very valuable. On the Jonah, cuts have been run on both ends of the claim, each uncovering the ledge and showing a width of five feet. As depth is obtained, the ore presents the same character as that found in the Toughnut.

CANADIAN COMPANIES.

The following is a list of the companies incorporated under the various Joint Stock Companies Acts, and also private concerns, for the pursuit of mining and kindred industries in 1890, together with the capital stock and chief places of business :—

Name of Company.	*Capital Stock.*	*Head Office.*
NOVA SCOTIA.		
Battye Freestone Co.	$ 25,000	Wallace. N.S.
Bras d'Or Marble Co.	200,000	Halifax, N.S.
Central Rawdon Mining Co.	120,000	Windsor, N.S.
Colchester Coal Mining Co.	50,000	Truro, N.S.
Coldstream Mining Co.	1,000,000	Boston, Mass.
Dufferin Gold Mining Co.	500,000	Truro, N.S.
Halifax Mining & Prospecting Co.	250,000	Halifax, N.S.
Mining & Development Co. of North America.	1,000,000	Boston, Mass.
Mooreland Gold Mining Co.	100,000	Halifax, N.S.
Napier Mining Co.	120,000	Oldham, N.S.
Northup Mining Co.	200,000	Philadelphia, Pa.
North Star Mining Co.	40,000	Halifax, N.S.
Nova Scotia Syndicate.	£ 12,000	London, Eng.
Queen's County Mining Co.	$ 1,000,000	Boston, Mass.
Rawdon Antimony Mining Co.	50,000	Halifax, N.S.
Rossignol Mining Co.	500,000	Boston, Mass.
Stanley Gold Mining Co.	40,000	Westville, N.S.
NEW BRUNSWICK.		
Windsor Gold Co.	100,000	St. John, N.B.
QUEBEC.		
Beaver Asbestos Co.	$ 100,000	Sherbrooke, Q.
Brompton Lake Asbestos Co.	60,000	Quebec, Q.
Fleming Phosphate Mining Co.	Private.	Ottawa, Ont.
General Phosphate Corporation.	£ 1,000,000	London, Eng.
Montawa Gold Mining Co.	$ 24,000	Joliette, Q.
Portland Phosphate Co.	Private.	Ottawa, Ont.
Richmond State Quarrying and Manufacturing and Asbestos Co.	150,000	Richmond, Q.
ONTARIO.		
Fairbank Consolidated Mining Co. of Ontario.	$ 500,000	Toronto, Ont.
Frontenac Phosphate Co	£ 10,000	London, Eng.
Gravel Bay Mining Co. of Ontario	$ 100,000	Toronto, Ont.
Haliburton Mining Co.	100,000	Toronto, Ont.
Kaladar Mining Co.	120,000	Napanee, Ont.
Kingston Phosphate Mining Co.	£ 5,000	London, Eng.
Kingsville Natural Gas & Oil Co.	$ 43,750	Kingsville, Ont.
La Cumbre Mining Co. of Toronto	70,000	Toronto, Ont.
Milton Pressed Brick & Terra Cotta Co.	50,000	Milton, Ont.
Ottawa Brick Mfg. Co.	45,000	Ottawa, Ont.
Ontario Gold & Iron Co.	100,000	Malone, Ont.
Portland Asbestos Co.	Private.	Ottawa, Ont.
Provincial Natural Gas & Fuel Co. of Ontario	500,000	Toronto, Ont.
Premier Oil Co.	150,000	Petrolia, Ont.
Sebastopol Phosphate Syndicate.	£ 5,000	London, Eng.
Silver Centre Mining Co. of Ontario	$ 300,000	Toronto, Ont.
Silver Glance Co.	£ 60,000	London, Eng.
Standard Asbestos Co.	$ 100,000	New York, N.Y.
Standard Oil & Gas Co. of Ontario	1,000,000	Stratford, Ont.
Vivian, H. H. & Co. (branch)	£ 328,000	Swansea, Wales.
MANITOBA AND N.W.T.		
Crowfoot Coal Co.	$ 125,000	Winnipeg, Man.
Crown Point Mining Co.	Private.	Duluth, Minn.
BRITISH COLUMBIA.		
Anglo-American Mining Co.	$ 3,000,000	Yale, B.C.
Black Jack Quartz Mining Co.	120,000	Barkerville, B.C.
British Columbia Pottery & Terra Cotta Co.	60,000	Victoria, B.C.
Columbia Mining Co.	500,000	Spokane Falls, Wash.
Crow's Bar Mining Co.	25,000	Vancouver, B.C.
Empire Consolidated Gold Mining Co.	500,000	Spokane Falls, Wash.
Golden Mining & Smelting Co. of Canada	400,000	Golden City, B.C.
Kokisilah Quarry Co.	100,000	Victoria, B.C.
New Eureka Silver Mining Co.	150,000	Victoria, B.C.

BRITISH COLUMBIA.—*(Continued).*

Name of Company.	*Capital Stock.*	*Head Office.*
Northwestern Gold & Silver Mining Co....	1,000,000	Victoria, B.C.
Saanich Lime Co......	50,000	Victoria, B.C.
South Fork of Quesnelle Hydraulic & Mining Co...............	Private.	Cariboo, B.C.
Vancouver Smelting & Mining Co.........	250,000	Vancouver, B.C.
Victoria Hydraulic Mining Co.............	100,000	Victoria, B.C.

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Company Notices.

Bell's Asbestos Company.—Mr. F. C. Bell has retired from the board and has resigned the office of managing director of this company.

Red Deer Valley Railway and Coal Company.—This company will apply to the Dominion Parliament at its next session, for an act amending the act of incorporation of the company and extending the time for complying with the conditions of the 89th section of the Railway Act, and for other purposes.

Alberta Railway and Coal Company.—Notice is given that the Alberta Railway and Coal Company will apply to Parliament at its next session for authority to construct and operate a railway from the westerly end of the line authorized by 53 Victoria, chapter 89, and in continuance thereof, through the Crow's Nest Pass to some point on the Canadian Pacific Railway in British Columbia and for other purposes.

Cumberland Railway and Coal Company.—Notice is given that the annual general meeting of shareholders of this company will be held at the company's offices, Imperial Buildings, Place d'Arms, in the City of Montreal, on Wednesday, the 11th day of February next, at 3.30 p.m. The transfer books will be closed from the 1st day of February until after the meeting.

Royal Gold Mining Company.—Application will be made for letters patent of incorporation under the " Nova Scotia Joint Stock Companies Act " by the above company, now doing a general mining and milling business at Whiteburne, Queens Co., N.S. The capital stock of the company is to be $50,000, divided into 500 shares of $100 each. The applicants are ; Charles Brown, Adoniram Curtis, Boston, Mass., James E. Cushing, Caledonia, N.S., Geo. W. Johnson, Yarmouth, N.S., Thomas Parker, Caledonia, N.S.

Jenckes Machine Company.—This company, which had applied to the corporation of Sherbrooke for a loan of $50,000 and exemption from taxes, have withdrawn their request. The city council offered a cash bonus of $10,000 and exemption for twenty years to the company, which was refused as too small, but the committee named for that purpose on visiting the works and becoming acquainted with the scale of the contemplated improvements, expressed a determination to recommend to the council the passing of a by-law granting the aid previously asked.

Medicine Hat Railway and Coal Company.—Application will be made to the Dominion Parliament, at its next session, for an act amending the act relating to this company, by extending the time for completing the same, and authorizing the company to continue and construct and operate its line of railway to a point on the international boundary line between sections one and eight, in the fourth range, west of the fourth principal meridian, Assiniboia, with power to connect there with any other line of railway extending from a southerly direction, and for other purposes.

The Kingston Light, Heat and Power Company.—Application will be made to the Ontario Legislature for an act confirming the amalgamation of the City of Kingston Gas Light Company and the Kingston Electric Light Company, or to create a new company under the above title with power to carry on the business of lighting, heating, and supplying power to the city of Kingston and vicinity ; to extend the charter, to increase the capital stock to $250,000, and for other purposes.

The Ontario Nickel Mountain Mining Co., (Ltd).—This company makes application for incorporation to the Ontario Legislature, for the purpose of carrying on a general mining business in the District of Nipissing. Head office, Toronto ; capital, $500,000, in 5,000 shares of $100 each. Applicants : G. S. Macdonald, W. B. Poulton, Margaret Poulton, J. K. Leslie, D. Hunter, W. H. Cathro, R. W. de Morest, Toronto ; R. Woods, A. Harvey, Whanapitae ; G. S. Macdonald, W. B. Poulton, and J. K. Leslie to be the first directors.

The Mutual Natural Gas Company of Port Colborne, (Ltd).—Application will be made to the Ontario Legislature for incorporation of the above company, to drill wells for natural gas, oil, and other mineral products, to construct pipe lines and for other powers. Head office, Welland, Ont.; capital, $20,000 in 200 shares of $100 each. Applicants : H. Cronmiller, De Witt Carter, E. Armstrong, F. King, J. D. Kinnard, L. G. Carter, and J. B. Neff, all of Port Colborne. H. Cronmiller, De Witt Carter and E. Armstrong to be the first directors.

The Lake Tamagoming Pioneer Company, (Ltd).—Application will be made to the Ontario Legislature to incorporate the above company for the purpose of dealing in timber lands, erecting saw-mills, dealing in mining lands, operating mines, smelting and refining ores, carrying on a general forwarding business by land and water, acquiring or building piers, railroads, wharves, roads, etc., and building hotels, etc. Head office, Toronto ; capital, $500,000, in 5,000 shares of $100. Applicants : Wm. Hendrie, Hamilton ; E. Wragge, A. Nairn, R. Jaffray, W. B. McMurrich, Toronto, all of whom are to be the first directors.

The Essex Moulding Sand Company, (Ltd).—Notice is given in the *Ontario Gazette* that Letters Patent have been issued to G. H. Walker, P. J. Conroy, G. E. A. Walker, P. Mulken, of London, Ont., and A. R. Ferris of the Township of Colchester, Essex County, incorporating the above company with power to dig for, sell and otherwise dispose of moulding sands ; to quarry for stone and like minerals, and to manufacture, sell and dispose of the same, together with the usual powers as regards real estate. The head office will be at London, Ont. The capital is $25,000 in 250 shares of $100 each.

The Ogema Mining and Smelting Company of the District of Thunder Bay, (Ltd).—The incorporation of this company by the Ontario Legislature will be asked for, to carry on an exploring, mining, smelting and refining business in silver, copper, lead, nickel, etc., with the usual powers. Chief place of business, Port Arthur ; capital, $150,000, in 3,000 shares of $50 each. Applicants : J. H. Sixsmith, C. Allen, H. W. Cranmer, of Camden, N.J., and C. B. Crosby, J. Mair and J. M. Scott, of Philadelphia, Pa., all of whom are to be first directors.

The Royal Bridge and Iron Company, (Ltd).—Application will be made to the Dominion Parliament for the incorporation of this company, for the purpose of carrying on the business of constructing and designing and manufacturing iron, steel and other bridges, and of all structural iron and steel, and to deal in all kinds of structural iron, steel and other metals. The chief place of business to be in Montreal. Capital stock $30,000, in 300 shares of $100 each. The applicants are : F. F. Miller, R. Fitzgibbon, W. M. Reid, A. W. Smith, and J. R. Gardiner, all of Montreal, the three first named to be the first or provisional directors.

James Pender & Company, (Limited.)—Notice is given of application to the New Brunswick Legislature for the incorporation of this company for the object of manufacturing wire, wire nails, horseshoe nails, nails of all kinds and descriptions, and articles of iron, steel and other metals. The chief place of business is to be at St. John, N.B. The amount of the capital stock is to be $100,000, divided into 1,000 shares of $100 each. The following are the applicants : James Pender, Walter O. Purdy, William Wheeler, John J. Gordon, of St. John, N.B., and Frederick E. Mariner of Chicago. The first three are to be the first or provisional directors.

Rocky Mountain Railway and Coal Company.—Notice is given that application will be made to the Dominion Parliament, at its next session, for an act to incorporate the Rocky Mountain Railway and Coal Company, with power to construct and operate a railway from a point on the line of the Canadian Pacific Railway Company, at or near Anthracite, in the District of Alberta, to a point on the Red Deer River, in the said district, with all powers conferred by the Railway Act ; and to construct and operate telegraph and telephone lines ; and with power to buy, lease, acquire, sell and mortgage coal and other mineral lands and mines ; and to mine coal and other minerals ; and to manufacture and sell the products of such mines and lands.

White's Asbestos Company.—The shareholders of this company assembled in general meeting last month in London, Eng. The accounts then submitted for adoption cover the period from April 13th, 1889, the date of establishment of the company, to September 30, 1890, that is, seventeen months. Out of £100,000 authorized capital, it appears that 15,000 shares of £1 each have been taken up and 17s. 6d. per share has been called, producing in cash £10,824. On the other side the directors have paid away £6,257 on account of purchase of property and plant, £1,254 expenditure at the mines, other expenditure £3,907, leaving cash at bank £904, and debtors £92. Of the other expenditure £1,476 is for directors' fees which have not been paid although charged. There is a *per contra* item of sundry creditors, £1,591. The report states that the progress made in development of the property has been very disappointing. The mines have been closed for the winter season. The properties worked on royalty have been abandoned in consequence of the unsatisfactory nature of the agreements under which the work was carried on.

Buffalo Lake and Battleford Railway Coal and Iron Company.—Application will be made at the next session of the Dominion Parliament for an act to incorporate the above company with power to construct, equip and operate a line of railway from a point on the line of the Calgary and Edmonton Railway at or near the crossing of the Blind Man's River in or near Township 39, range 27 west of the 4th initial meridian, in the District of Alberta, and running easterly to the Red Deer River in or near Township 39, range 23 west of the same meridian, thence north-easterly to the Battle River in or near Township 40, range 15 or 16 west of the same meridian, thence easterly to Battleford. And also to construct, equip and operate a branch line from a point in the main line in or near Township 40, range 15 west of the same meridian, and running south-westerly to or near Township 33, range 22 west of the same meridian. Also with powers to the same company to acquire lands for coal, iron and other mines, and to work such mines. Also with power to construct and operate a telegraph or telephone line in connection with the said railway, and, generally, with all powers, rights and privileges usually granted to railway companies under charters of incorporation.

The British Columbia Iron Works Company, (Ltd.)—Application will be made to the Legislature of British Columbia, to incorporate the above company, for the purpose of manufacturing all kinds of saw mill, mining and marine machinery, agricultural implements, pumps, hoisting machinery, derricks, cranes, dredges, excavators, boilers, machine tools, safes and vaults, and generally to carry on a blacksmithing foundry, boiler-making and machine business in all its branches ; to act as agents for the sale of machinery and machine supplies of all kinds ; to build and repair ships and steamers, and vessels of all kinds ; to purchase, sell or lease any lands or premises, wharves or docks for the carrying out of the above purposes. The capital stock of the company is to be $50,000 divided into 1,000 shares of $50 each. The time of the existence of the company shall be fifty. The principal place of business shall be in Vancouver, B. C., and the number of trustees shall be four, consisting of the applicants, viz., John G. W. Macfarlane, J. W. Campion, J. Whetham and Wm. Hickey, who shall manage the affairs of the company for the first three months.

The West Waverley Gold Company (Limited.)—Notice is given of application for the incorporation of a company under the above title, according to the provisions of the statutes of Nova Scotia, for the purpose of purchasing, acquiring and owning of gold areas, timber and other lands, the development, exploitation, working and operating of gold mines, deposits carrying gold and associated metals, winning, raising and milling such metalliferous ores, selling and disposing of the gold and other metals produced therefrom ; constructing, maintaining and operating all mining and milling machinery and appliances necessary for the aforesaid purposes ; the selling and disposing of gold mines and gold mining areas, and lands belonging to such company. The chief place of business of the company is to be Waverley, in the county of Halifax, Nova Scotia. The intended amount of the capital stock is sixty thousand dollars in six thousand shares of $10. The names of the applicants are J. C. Ayer, of New York, manufacturer ; Charles F. Ayer, of Lowell, Mass., lawyer ; Frederick Taylor of the last named place, merchant ; John E. Hardman, of Oldham, Halifax Co., Nova Scotia, mining engineer; and Edmund L. Newcombe, of Halifax, N.S., barrister. The first or provisional directors of the company are to be J. C. Ayer, John E. Hardman and Edmund L. Newcombe.

Goldie & McCulloch.—Application will be made to the Dominion Parliament at its next session to incorporate this company for the purpose of carrying on of all or any business of manufacturers of steam engines, boilers, water wheels, heaters, pumps and all necessary parts and appliances for the working of the same ; flouring, saw-mill, shingle, stave and barrel machinery, steel and iron shafting by turning, drawing or grinding, woollen and cotton mill machinery, wood working machinery, wood and iron machinery of every sort and description ; millwrighting in all its departments, patternmaking, fire and burglar proof safes and vault doors of all kinds ; steel and iron chests of all kinds, and also any materials, machinery, apparatus, appliances, articles and things required for or in connection with or incidental to or which shall be capable of being used for the purposes of any of the said businesses or dealings ; to carry on the business of founders, mechanical engineers, machinists and elecro-platers, and whatever may be incidental or collateral to the same ; to have the customary powers as regards real estate and other property ; to have power to apply for purchase or otherwise acquire or dispose of any invention, letters patent, etc. The chief place of business of the company is to be at Galt, Ontario. The proposed amount of the capital stock is $700,000, divided into 1,400 shares of $500 each. The names of the applicants are as follows : John Goldie, Hugh McCulloch, sr., Hugh McCulloch, jr., Galt ; Robert McCulloch, Toronto, Ont., and David Goldie, Ayr, County of Waterloo, Ont. The first or provisional directors of the company are to be John Goldie, Hugh McCulloch, sr., and Hugh McCulloch, jr., all residing in Canada.

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Canadian Companies.

ENGLISH QUOTATIONS.

	Price.	
Excelsior Copper, Limited, £410,738 fully-paid shares of £1....	—	
Nicola, Limited, £35,000 fully-paid shares of £1..............................	—	
Shuniah Weachu, Limited, £99,888 fully-paid shares of £1........................	$\frac{1}{16}$	$\frac{3}{16}$
Silver Wolverine, Limited, £68,465 fully-paid shares of £1......................	—	

Tilt Cove Copper, Limited, £160,000 fully-paid shares of £2	—	
Ditto, £80,000 5½ per cent. debentures	—	
General Mining, Limited, £219,752 fully-paid shares of £8	3½	4
Low Point, Barrasois and Lingan, £509,100 fully-paid shares of £100	—	
New Vancouver Coal Mining and Land, Limited, £185,000 fully-paid shares of £1	¾	1
North-Western Coal and Navigation, Limited, £160,500 6 per cent. debenture coupons, June 30 and December 31 ; principal 1904	—	
Ditto, £149,500 full-paid ordinary shares of £10	—	
Ditto, £900 fully-paid deferred shares of £100	—	
Sydney and Louisburg Coal and Railway, Limited, £50,000 cumulative 10 per cent. first preference shares of £10, £6 paid	7½	8½
Ditto, £14,560 fully-paid non-cumulative 6 per cent. second preference of £10	3	5
Ditto, £250,000 fully-paid ordinary shares of £10	¼	¾
Anglo-Canadian Asbestos, Limited, £11,500 fully-paid shares of £2	—	
Anglo-Canadian Phosphate, Limited, £46,510 fully-paid preference shares of £10	—	
Ditto, £25,000 fully-paid deferred shares of £10	—	
Bell's Asbestos, Limited. £140,000 fully-paid shares of £5	13⅞	14⅛
Ditto, £68,400 debentures, 5 per cent.; interest January 1 and July 1	—	
Canadian Phosphate, Limited, £100,000 fully-paid shares of £1	—	
General Phosphate, Limited, 5 per cent. ordinary shares of £10, £2 paid	—	
Ditto, £5,000 fully-paid founders' shares of £10	—	
Western of Canada Oil, Limited, £200,000 fully-paid shares of £100	—	
Ditto, £99,850 fully-paid shares of £50	—	
Western of Canada Oil, Limited, £199,700 12 per cent. debentures of £100	—	
White's Asbestos, Limited, £20,000 fully-paid shares of £1	—	
Ditto, £15,000 shares of £1, with 15s. paid	—	

Excelsior Copper.—Registered September 26, 1888. Accounts to December 31 submitted in April. No dividend yet. Liquidation and reconstruction have been decided upon.

Nicola.—Accounts to September 30 submitted in November. No dividend yet.

Shunia Weachu.—Accounts to November 20 submitted in February. No dividend yet. Shares for £12,870 held by the Company.

Silver Wolverine.—Registered October 19, 1888. Annual meeting to be held about March 1891.

Tilt Cove.—In March, 1890, the properties were leased for 99 years to the Cape Copper Company, Limited, at a rent of £4,400. The Cape Copper Company advance £15,000 at 5 per cent. interest, and when this is repaid out of profits surplus profits are to be divided equally between the Cape Copper Company and the Tilt Cove Company. The lease may be determined by the Cape Copper Company at any time on twelve months' notice. Accounts annually to March 31, submitted in November.

General Mining.—Accounts to December 31 submitted in April, but an interim meeting is held in November. Dividend for 1884, 5 per cent.; for 1885 and 1886, 3⅛ each year; for 1887, £4 13s. 9d. per cent., and for 1888 and 1889, 3¾. Reserve fund, £29,850.

Low Point.—Accounts to December 31. For 1887, 1888, and 1889, 5 per cent. was paid each year on the ordinary shares publicly held ; for 1888 the ordinary shares issued to the vendors got 3½ per cent., and for 1889. 2½.

New Vancouver Coal.—Reconstructed in 1889. Accounts to June 30 and December 31 submitted in November and May. For the two half-years to June, 1889, 5 per cent. per annum was paid, and for the two half-years to June, 1890, 4. Debentures, £57,700.

North-Western Coal.—The deferred shares receive no dividend until 15 per cent. per annum (cumulative) has been paid on the ordinary. Accounts to June 30. Dividend for 1887-8 and 1888-9, 5 per cent. per annum.

Sydney and Louisburg Coal.—Accounts to December 31 submitted about May. In respect of 1889 15 per cent. was paid on the first preference, leaving arrears of 50 per cent.

Anglo-Canadian Asbestos.—Reconstructed in 1889. Debentures, £3,450.

Anglo-Canadian Phosphate.—The preference shares rank first for 7 per cent., and after a like rate has been paid on the deferred shares, both classes rank equally. Accounts to November 30, submitted in May. No dividend yet on either class. Debit to profit and loss on November 30, 1889, £4,744. One of the mines has recently been sold and another leased.

Bell's Asbestos.—Accounts to December 31 submitted in January. Dividends for 1888 and 1889, 22½ per cent. each year. Reserve, £5,000. The debentures are redeemable by 1913, by annual drawings at 115 from a sinking fund, which the directors may increase.

Canadian Phosphate.—Accounts to November 30 submitted in February. Eleven months to November 30, 1888, resulted in a profit of £2,576, which was carried forward. A dividend of 6d. per share is to be paid November 1, 1891.

Another Meeting of Mine-Owners in Montreal—A Mining Association Formed.

An important meeting of owners and operators of mines and mineral lands in the Province of Quebec, was held in the Windsor Hotel on Friday, the 16th instant. There was a good attendance, among others present being: The Hon. George Irvine, President, Johnson's Asbestos Co., Quebec; Mr. W. H. Irwin, Anglo-Canadian Asbestos Co., Montreal; Capt. Robert Adams, Anglo-Canadian Phosphate Company, Montreal; R. T. Hopper, Anglo-Canadian Asbestos Company, Montreal; J. B. Smith, M.E., Anglo-Continental Guano Works Company, Buckingham; S. P. Franchot, Villeneuve Mica Mines, Buckingham; O. M. Harris, Canadian Phosphate Company, Montreal; George R. Foster, representing Excelsior Copper Co., Montreal; Adolphe Lomer, representing the East Templeton District Phosphate Mining Syndicate and other important companies, Montreal; C. B. Falardeau, Canada Industrial Company, Montreal; W. A. Allan, Little Rapids Mining Co., Ottawa; S. H. Fleming, Fleming Phosphate Co., Ottawa; C. M. Gibbs, Dominion Phosphate Company, of London; Dr. C. Killing, Amsterdam, and a number of others. Capt. R. C. Adams, occupied the chair, and Mr. B. T. A. Bell acted as Secretary.

Letters of apology were read from Mr. R. N. Hall, M.P., Sherbrooke; Mr. W. H. Nichols, New York, and others.

The chairman, having explained that the object of the meeting was to consider the operation of the new Bill affecting the mining interests of the Province, an animated discussion took place on the most feasible steps that should be taken to protect the industry. The following resolutions were adopted :—

(1) *Resolved*—That a General Mining Association for the Province of Quebec be now formed;

(2) *Resolved*—That the following gentlemen be nominated a Committee to prepare a Draft Constitution for said General Mining Association:—Hon. George Irvine, Johnson's Asbestos Co., Chairman; B. T. A. Bell, Editor CANADIAN MINING REVIEW, Secretary; S. P. Franchot, Ottawa Mining Co.; O. M. Harris, Canadian Phosphate Co.; W. H. Irwin, Anglo-Canadian Asbestos Co.; J. N. Greenshields, Q.C., Excelsior Copper Co.; J. B. Smith, Anglo-Continental Guano Works Co.; W. A. Allan, Little Rapids Mining Co.; Capt. Robert C. Adams, Anglo-Canadian Phosphate Co.; James King, King Bros., Quebec; George E. Foster, Montreal; C. M. Gibbs, Dominion Phosphate Co., of London.

(3) *Resolved*—That the mining men of the Province, and all interested directly or indirectly in the welfare of its mining industries, be invited to join and co-operate in the work of said Association; and that the Secretary be instructed to invite them to a meeting to be held in the Windsor Hotel on Friday, 30th January next. for the purpose of ratifying the Constitution, the election of office-bearers, and other business.

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Strikes and Their Cost.

An official report upon the strikes and lock-outs of 1889, compiled by Mr. J. Burnett, Labor Correspondent of the British Board of Trade, has just been issued as a Parliamentary paper, and contains facts and figures which are well worthy of careful consideration. Some of the conclusions drawn by Mr. Burnett have been disputed already by one of the trade union secretaries, but for the practical purpose of estimating the cost and incidence of strikes the facts and figures of the report hold good. During the year 1889 there were strikes in 3,164 establishments, the number of distinct strikes being 1,145. Of that total 9·7 per cent. were among miners, 9·34 per cent. in the shipbuilding trades, 8·5 per cent. in the engineering trades, and 7·5 per cent. among dock and wharf laborers. Most of the strikes were due to claims for higher wages. Of the total number 48·3 per cent. were successful, 31·5 per cent. were partially successful, 10·7 per cent. failed, and in the remainder the results are not known. There were forty-five strikes in opposition to proposed reductions of wages, and one-fourth of them were successful, whilst twenty failed wholly. As many as twenty strikes were due to the sympathy of one body of workers not actually involved with those directly engaged in the struggle. Mr. Burnett states that in the 304 strikes which were successful, 93,524 persons were concerned, and in the 272 partially successful strikes 175,476 persons were involved. In the 171 strikes which failed, 40,472 persons were concerned. In arriving at settlements of the disputes 62·3 per cent. were solved by means of conciliation, and in 4·2 per cent. arbitration was resorted to after the conciliation. As regards the total number of persons involved in the whole of the strikes, the statistics are not absolute, but it is known that in 930 strikes there were 344,840 persons directly and indirectly concerned. As to the duration of the strikes, details are furnished of 840, in which the aggregate number of days lost was 15,100. The average duration per strike was 18·6 days, which gives an aggregate loss of 3,730,000 working days, which, at 3s. 6d. per day, would be a loss of wages alone of £662,000. A fuller calculation and an allowance for the much higher rates of wages received by many of the strikers would in all probability more than double the total just given. In regard to the losses inflicted upon the employers, it is shown that in 216 instances only, the value of the fixed capital laid idle was £14,480,962, while in 169 instances the ratable value of the property laid idle was £268,684. In 233 cases the estimated outlay caused through the stopping and re-starting of the works was £169,212. In ten cases it is stated that £6,517 was paid by organizations of employers in support of firms whose men were on strike. On their part the trade unions in 369 strikes paid £63,636. There are in Mr. Burnett's report many other figures of considerable interest, but those we have quoted serve to give an approximately accurate idea of the heavy bill paid by the country in respect of the wages agitations of last year. That bill, moreover, cannot be deemed to be complete without a large addition for the loss of business—temporary or permanent—resulting from these serious disturbances of our labour market, and by the higher selling prices necessitated by the augmented cost of labor. On several occasions we have pointed out the losses caused in this way, and have expressed the hope that some day strikes will be wholly prohibited. The trade union leaders take credit to themselves, in criticising Mr. Burnett's report, for the general advances in wages which they have secured by means of the strikes, but they do not deprecate such violent methods of negotiation, and appear to be satisfied to resort to what is virtually brute force rather than to assist in the constitution of a proper tribunal for dealing with all labor disputes as they arise.

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Minerals, Chemicals and Colors.

(From Geo. G. Blackwell's Report.)

LIVERPOOL, January 16.

MINERALS.—The firmness reported in our market last week has continued. Manganese: Arrivals still small, and prices remain firm. Magnesite: Stocks continue large, and prices low. Raw ground £6 10s, and calcined ground £12 10s. Bauxite (Irish Hill brand): The demand for this article is increasing considerably at advanced figures. French chalk: More arrivals this week; all, however, have gone into consumption; prices remain firm. "Angel White" brand, 97s 6d to 105s 0d, medium, 110s 0d to 120s 0d superfine. Barytes: Carbonate continues easy, whilst sulphate of fine quality is scarce, "Angel White," No. 1 70s 0d., No. 2 60s 0d to 65s, No. 3 45s. Pumice-stone: Both lump and ground steady. Iron ore unaltered, also manganiferous and Santander; Irish and Cumberland in good demand at full prices. Emery stone: Fairly brisk for best brands; No. 1 lump £5 10s to £6, smalls £5 to £5 10s. Fullers' earth: Best lump, 55s; fine impalpable ground, £7. "Emerald" ground 80s. Scheelite, wolfram, tungstate of soda, and tungsten metal steady at fair prices. Chrome ore: The demand for high grades continues good at full prices. Antimony ore and metal steady. Asbestos firm, especially Canadian Rock. Potter's lead ore of best quality in demand; smalls, £13 to £14; selected lump £15 to £16. Calamine of high grades sought after at full figures. Strontia sulphate (celestine) steady, 15s 6d to 17s. Carbonate (native), £15 to £16; powdered (manufactured), £11 to £12. Limespar: A good business doing; English manufactured old G.G.B, brand in request at 50s (ground). Felspar and fluorspar easier. Plumbago: Best qualities sought for; Spanish, £6; best Ceylon lump at last quotations; Italian and Bohemian, £4 to £12 per ton. "Founders," £5 to £6; Blackwell's "Mineraline," £10. French sand, in cargoes, 20s to 22s 6d. Ground mica, £50. China clay steady; common, 18s 6d; good medium, 22s 6d to 25s; best, 30s to 35s (at Runcorn). Irish moss: More doing at higher figures. Bog ore (oxide of iron) scarce; finest quality 22s.

COLORS without alteration. Ochres: Oxfordshire, common £10; medium £12; best £15. Derbyshire, common 40s; medium, 50s; and best 60s. Welsh best 50s; seconds, 47s 6d; and common 18s; Irish, Devonshire, 40s to 45s; French, J.C., 55s, 45s to 60s; M.C., 65s to 67s 6d. Umber: Turkish, none offering. Devonshire, 50s to 55s. White lead, red lead, and oxide of zinc still firm. Venetian red, £6 10s. Cobalt: Prepared oxide, 10s. 6; black, 9s 9d; blue, 6s 6d. Zaffres: No. 1, 3s 6d; No. 2, 2s 6d. Oxide of iron: Good inquiry; common, £6; medium, £10; finest, £20.

CHEMICALS.—The tone of our market this week remains unchanged. Soda ash 1⅜d up. Caustic soda firm; 60 per cent. white, £10; 60 per cent. cream, £9-£12s 6d; and 70 per cent. white, £11 10s; 74 per cent., £12. Bicarbonate, £5 15s. Nitrate of soda, 8s 6d to 9s. Soda crystals, £3 10s. Bleaching powder £7 2s 6d. Salt cake, 42s 6d. Chlorate of potash, 5¼d. Arsenic strong at £14. Sulphate of copper, £18 10s to £19. Manganese: Sulphate, £22; chlorate of manganese, £15 per ton; carbonate, £12 10s; borate, best English make, 6¼d; oxalate, 1s 6d. Chloride of magnesium (antiseptic) strong at 45s to 50s. Montreal ashes; Pot 32s; pearl, 45s to 47s.

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The use of the Telephone in Mines.—The telephone is getting to be a great thing in coal mines. The Philadelphia *Ledger*, referring to its use in this way, says: "Most mines are to a certain extent in difficult positions on precipitous mountains. The telephone enables the manager to be in close communication with his mine at all hours, both day and night. When difficult ground or heavy flows of water are encountered, arrangements can be made to control the situation at once, without the loss of hours in communicating the necessity. The electric bell and annunciator now tell the story of what is wanted and what is going on below in deep shafts and inclines. The touch of the button tells the top men and engineers f ore waste, tools or men are coming up, and what level they are coming from. Another signal tells if timber, wedges, tools, or the foreman are required below."

MACHINERY MECHANICS & INVENTIONS

Mining Machinery with Special Reference to Ore-Dressing Appliances.

The following lecture was recently delivered by Prof. Clarkson at the International Exhibition of Mining and Metallurgy, London ;

The previous lectures have taught us much relative to the vast mineral wealth of the various colonies, and have specially pointed out the necessity for improved mechanical appliances to deal with these enormous deposits. Consequently it is to be regretted, that in this series of lectures, there should be only one to deal with the very large and important subject of mining machinery. As evidence of its scope, it will suffice to point out that the title, "Mining Machinery," comprises engines, boilers, pumps, winding gear, waterwheels, and turbines, air compressors, rock drills and their accessories, ore breakers and pulverizers, machinery for amalgamating, classifying, concentrating and chlorinating, diamond and coal washing machinery, railways, elevators, and conveyors, electric transmission of power, lighting machinery, telpherage, transport, etc. Now, it is obviously quite impossible, in the short time at our disposal, to deal with more than a small section of this comprehensive subject ; I have, therefore, specially selected ore-dressing machinery. In considering the particular requirements of mining machines in general, we may gain much by looking for a moment at the essentials to all successful mechanical appliances. And first in the list stands efficiency. This may be either commercial or merely scientific. The difference will be obvious to all—*e.g.*, Pancellier's combination of links may be the best appliance for drawing a mathematical straight line, but for ordinary use it could never compete with the simple ruler, and so in all. If a machine doing ten per cent. better work than another, costs twenty per cent. more in repairs, it will have to give way in favor of its comparatively less efficient rival. Simplicity will always play a very important part in the question of efficiency, and this is especially true of mining appliances. The stamp-battery furnishes an excellent illustration of an essentially simple contrivance triumphing for years over others of greater efficiency and complication. Scientific investigators may point out fundamental principles, but the work of the mechanical engineer may be defined as the art of simplifying the application of scientific formulæ to the attainment of commercial success. The second point we shall consider is the economy of material in the design of machines. This is to some extent implied by the condition of simplicity, and is rendered particularly necessary by the difficulties of transport —*e.g.*, in the present collection of machinery we have pulverizers of different types, ranging in weight from two to ten tons for the same output. What is required is a correct distribution of the most suitable material to fully meet all requirements of stress, strain, wear and tear. Frequently machines have to be made much stouter than is required by their normal work in order to meet extraneous requirements, such as excessively rough handling in transport, etc. Many American machinists seek "lightness of design" to an unreasonable extent, whereas English engineers have often gone to the other extreme. The third and last essential that we shall notice is beauty of form, and this may at first sight appear quite superfluous in mining appliances ; nevertheless, its consideration by engineers in other fields has established its importance, and an improvement in this direction is promised for future mining machines. One of the first and chief things noted by investigators of old mining appliances, is the great want of any adequate consideration of the foregoing rules. Indeed, it was stated only the other day by one of the leading exhibitors of machinery, that until very recently the subject has received scarcely any scientific attention, and mining men have been quite satisfied to proceed on the old lines ; however, it is to be hoped that the present exhibition will greatly help to overcome the prejudices of a notoriously conservative fraternity. It is not my intention to animadvert any particular machines, but rather to endeavor to supply information to the uninitiated, thereby increasing the educational value of the present fine collection of machines. We will therefore assume that the ore has been "brought to grass." The problem now is to extract the metals as efficiently and as cheaply as possible. We must note the special reqirements called for by the physical conditions of the country, the difficulty and expense of transport, the quality and cost of the fuel to be used, the scarcity of water, the class of labor available, and the nature of the ores to be treated. The first operation will be a careful inspection of the ore to determine its nature and value as completely as possible ; which metals are present, and how much of ch ; do they occur in the metallic form, or in chemical combination ; the relative hardness of the constituent minerals, and their ease of pulverization. Next, does the metallic mineral occur in large compact masses, or is it very finely disseminated through the rock (this will indicate to what extent it is necessary or advisable to pulverize) also the specific gravity—as a guide to "concentration." From the above, and probably other considerations, it will be possible to form a very correct idea of the best treatment and best machinery for any particular ore, and it will be now clearly seen why a pulverizer doing excellent work with one kind of ore may not be equally successful with all. The large lumps of ore must be first passed through the rock breaker, which machine has been brought to a high degree of perfection. At the present time there are only two types of mechanism used in stone breakers, viz. : the toggle joint and the eccentric, and by a little mechanical analysis these can be easily resolved into one. The only draw-back to the toggle is, that breaking only takes place during half the stroke. A successful attempt has been made to obviate this in the Gates' eccentric continuous crusher, but the great crushing force is derived in much the same manner. As the vast majority of ores are brittle and fairly hard, they may be readily pulverized in either stamp, roller, or ball mills. The modifications in design of the two latter classes of machines are so multitudinous, that it would be futile to attempt any detailed descriptions. In ball mills, one, two, or three, or a multitude of balls are placed in a suitable vessel, the whole or part of which is made to revolve, and pulverization is effected by the rolling action of the balls. The only representative in this class in the exhibition is Mr. Jordan's fine reducer. Other pulverizers have a breaking, grinding and tearing action, and are more capable of dealing with tough, soft and elastic substances. A good machine of this class is the "Cyclone Pulverizer" which has succeeded in reducing wrought iron or even india-rubber to a fine powder. High speed mills of the "Cyclone" and "Sturtevant" type require a lot of power, frequently 20 h.p., to an output of one ton per hour, and special attention must be continually paid to the bearings where a speed of from 2,000 to 3,000 revolutions per minute is attained. The essential requirements in a good pulverizer appear to be : 1. The production of a uniform sample with a minimum of slimes. What is required is a mill that will crush the bulk to pass a 60-screen and will not produce more than ten per cent to pass 100. Improvements will be effected in this direction by increased facilities for removing the particles of ore, immediately they are sufficiently reduced, thereby preventing undue battering and the consequent loss of power ; removal by upward draft in dry machines is bad. Secondly the grade or size should be adjustable. This brings us to the next consideration, viz. : the ratio of output to power expended, which should be obviously as great as possible, and varies in existing machines according to their design from 6 to 20 h.p., for an output of one ton per hour. This is a very great variation, and is governed by the question of speed, the weights to be moved, friction and the above-mentioned facilities for the rapid removal of the pulverized ore. The fourth consideration is that of weight of machine to output. This is especially important, of course, where transport is difficult. It appears to vary from 2½ to 10 tons for an output of one ton per hour. The cost of maintenance is, of course, a very important factor, and no very reliable figures can be given. In place of these, however, we may note some of the most fruitful causes of wear and tear, breakdowns and stoppages. It is clearly inevitable that a machine doing such fearfully rough work as the smashing-up of hard rock, will suffer considerably in some of its parts. These should be made light, of the simplest form, and of the most durable material, such as steel or chilled iron, and when worn out should be readily replaced with the minimum loss of time. Careful protection against grit should be afforded to the bearings, especially when a high speed is employed, and strength considerably in excess of the normal requirements should be provided to meet such emergencies as the accidental presence of a steel wedge or chisel with the ore. Formerly "wet pulverizers" were used almost exclusively, but it is satisfactory to note that "dry mills" are now coming to the front. If the "ore direct from the mine" is sufficiently pure, as is sometimes the case, it may be transferred at once to the smelting house, but in the vast majority of cases the "gangue" predominates to such an extent as to greatly impoverish the ore, thus necessitating a sorting operation before the metals can be profitably extracted. This operation of enrichment is known as "concentration" and may be popularly defined as "retaining in smaller bulk the valuable portion of the ore." Excepting the hand-sorting of some of the larger pieces, "concentration" is performed by mechanical appliances, in which either water or air is used to remove the associated "gangue." In considering the various physical properties of the associated particles of ore we shall be most struck by the great difference in the specific gravities of the metallic and non-metallic mineral—in fact, but for this variation in the weights no mechanical concentration would be possible, excepting the one or two cases subject to magnetic influence. But clearly the weights of the particles are not fixed merely by their specific gravities, but by their size and form. Everybody knows that a small piece of lead may weigh as much as a large piece of stone, consequently unless a classification according to size is made, no good concentration must be expected whatever appliance may be used. It has been pointed out under the heading of pulverizers, that although an ore may be ground to pass a twenty mesh there is sure to be an infinite variety in the size of its particles, and it is scarcely necessary to mention that it is perfectly hopeless to invent a pulverizer that will produce practical uniformity in this respect. To emphasize the importance of this classification permit me to quote from the opinions of several authorities upon the subject : "Mr. Frecheville, one of H.M.'s Inspectors of Mines, stated before the Mining Institute of Cornwall, in 1884, in reference to the unsatisfactory concentration of tin ore by jigs at the Wheal Jane Mine, that the material was discharged from the stamps into the concentrators without any classification, and under such conditions there could be no perfect dressing with a jigger, nor with any other machine, but he could see no reason why a combination of jigging and huddling introduced into Cornish mines and preceded by sizing, could fail give satisfactory results." Mr. Philip Argall (manager of a large lead works in Denver, Colorado) stated : "Classifications of the material to be operated upon, is really the secret of good dressing, no matter what method may be adopted for separating." Mr. Rennert, engineer of Johannesburg, has written that the "successful working of any concentrator will be greatly affected by proper sizing." To conclude with an extract from the famous book of Kustel ! In speaking of Hunter's self-discharging percussion-table he says : "The general fault in treating these tables is overcharging with unsized ore. This may often be the cause of bringing a really good machine into discredit." This expression of opinion you will doubtless consider more than sufficient to establish the importance of "sizing ;" let us, therefore, now consider the means available. The old-fashioned and still extensively used appliance is the sieve or screen, which may be arranged in an endless variety of ways. The forms of revolving screens are legion, and in addition to these, there are parallel screens, parallel-compound screens, parallel-stepped screens, screens with cams and lifting wheels, and many others, each description having its separate use, advantage, and partisans. A good dry classifier is still a want. We must pass on now to concentrates, and as time is so short we must confine our attention to typical examples of each class. Concentrating machines are either stationary, percussion, oscillating, and shaking tables, or steady-moving contrivances, and preference is always given to self-discharging continuous mechanisms. The most primitive blanket-table catches some fine Au and amalgam from stamps. Very fine Au is troublesome to save, but cannot be compared to very fine Ag. ores in this respect. Blanket stuff is comparatively poor, sometimes sixty feet long. After some further remarks the lecturer said a few words on the treatment of refractory gold ores. Probably the best treatment was a direct concentration, the following two cases excepted : (1) If the concentrates were designed for smelting on account of Pb. Ag., in which case the ore by a preceding amalgamation was saved from the unavoidable smelting loss of 3 to 4 per cent. (2) If the concentrates were intended for extraction of ore by chlorination, whereby coarse ore particles were not readily dissolved, the loss in wet concentration averaged about 12 per cent., depending, however, much upon the condition of the ore and the "gangue." This loss consisted in the finest and most unfavorably-shaped particles, of which a portion might escape amalgamation.

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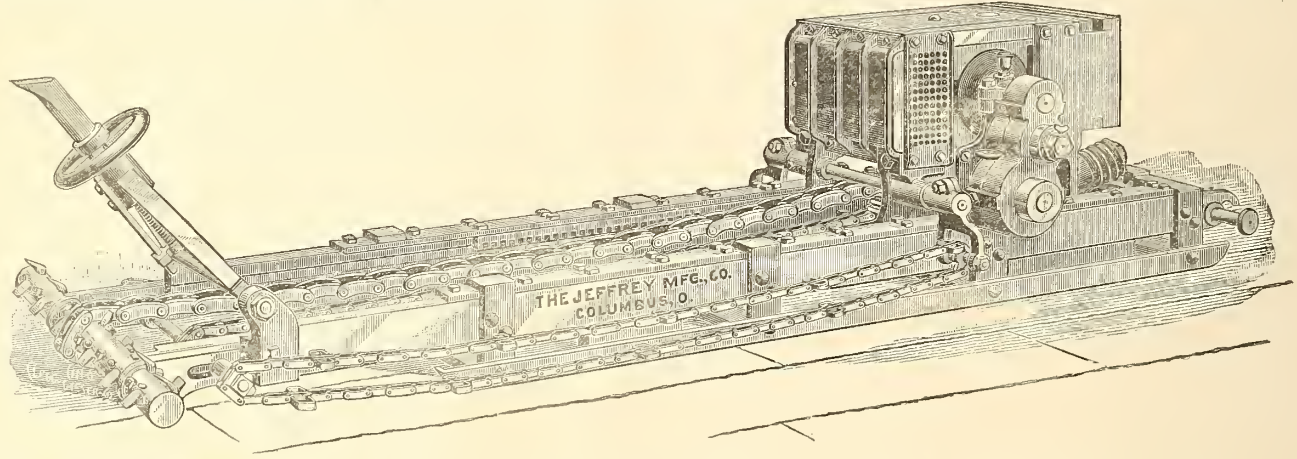
An Electrical Coal Mining Machine.

The transmission of power by electricity is rapidly superseding most other means, but although applied in almost every branch of mechanics above ground, it has, until now been almost unknown in mining operations, and the introduction of an electrical coal mining machine by the Jeffrey's Manufacturing Company of Columbus, Ohio, marks an important step in this connection. This concern is already well known through its "air power machines," the success of which has long been recognized, but their present venture is likely to supercede this and all others when its merits are fully established. Some description may prove of interest. The machine consists of a bed frame occupying a space two feet wide by seven feet six inches long, composed of two steel channel bars firmly braced, the top plates on each forming racks, with their teeth downward, into which feed wheels of the sliding frame engage. Mounted upon, and engaging with this bed frame, is a sliding frame, similarly braced, consisting mainly of two steel bars, upon which are mounted at the rear ends, one electric motor, from which power is transmitted through straight gear and carried to the rack, by means of which the sliding frame is fed forward. Upon the front end of this sliding frame is mounted the cutter bar, held firmly by two solid steel shoes with suitable brass boxes. The cutter bar contains bits, made of tool steel, held in place by set screws, and when revolved, these cutters or bits cover its entire face. The cutter bar is revolved by an endless curved link steel chain from the driving shaft, and as it is revolved, is advanced by the above mechanism into the coal or other material, to be under cut to the desired depth. The electric motor occupies a space of about 20 inches square, is built in the most workmanlike manner, both mechanically and electrically, and has an efficiency of 90 per cent. The current required is from 30 to 50 amperes at a pressure of 220 volts; each motor is wound to develop fully 15 h.p., though frequently in some veins of coal, the machinery only uses 30 amperes, or 7½ h.p., in making cuts. The machine is started by means of a switch located on a suitable resistance box, in the rear end of the motor, the same being arranged with buttons; the current is gradually turned on by passing a lever over these buttons. The armature of the moter is calculated to run at a speed of 1,000 revolutions per minute, from which the speed is reduced so as to run the cutter-bar 200 revolutions per minute. The momentum of the armature is such that ordinary obstructions met by the cutter-bar in the coal are not perceptible, causing the machinery to run steadily and comparatively quietly. The machines are operated by two men; one man in charge and the other as helper. Trucks are furnished with the machines which enable them to be handled with ease. The machine is taken into the mine upon this truck and run into the room to be under-cut. It is then placed on two boards in front of the coal at one side of the room, and is fastened firmly by means of the front and rear jacks, which are braced against the face and roof of the coal; this prevents the machine from moving while in operation. The power is then turned on by the machinery operator, and the machine proceeds to its work. The cutter, which is revolved by an endless chain, is fed forward, by means of rack and pinion wheels to a depth of five or six feet, according to the size of the machine. The usual length of the cutter-bar is 39 and 42 inches. When the full depth has been reached the feed is thrown off, and by means of a reverse lever, the cutter-bar is withdrawn to its starting place. This completes the cut, and the machine is moved over the length of the cutter-bar used, and another cut is made in the same manner. This is continued until the entire width of the room has been under-cut, after which the machine is again loaded on the truck and taken into another room. These cuts are made on an average of from four to six minutes each. The amount of coal under-cut, or the lineal feet face for each machine, depends upon the quality of the coal, and the skill of the men handling the machines. In some coal veins the machines have cut at the rate of 130 and 150 lineal feet face in ten hours to a depth of six feet. Twice this amount can be cut if the machines are run on double shift. The construction is very simple, so that any person of ordinary intelligence can understand and handle it with a few days' instructions. Some of the advantages of its use may be thus summed up: The saving in the reduced cost of mining; the saving and better condition of the coal; it cuts away but four inches of the seam; the work is concentrated in the mines, requiring but one-third the number of rooms to produce a given number of tons of lump coal, as compared with hand labor; reduction of dead work, having less track to lay to the several rooms because of concentration, requiring fewer boys and horses for gathering purposes; if underlaid with fire clay the cut may be made in that, thus saving the coal; it drives all entries and turns the rooms; the machine will cut the coal on any level desired, either at the bottom or at any level above, and if thought desirable to cut out any seam of slate occurring from ten to eighteen inches above the bottom, it may be done, as the machine will cut the slate as readily as the coal; the lighting of the mines by incandescent lamps; and hauling the coal by electrical car motorage. With these advantages it will be evident, that an investigation into this machine, on the part of coal operators, will be to their interest. As regards the cost, it depends very much upon the distance the power is conveyed, and also upon the local circumstances surrounding the mines, the skill with which it is handled, and the steadiness with which the mines are kept running, but it may be stated in a general way, that the saving on the average is from 25 to 33⅓ per cent. on account of the small amount taken out in the bearing-in. As yet electricity is but in its infancy as a motive power, and further improvements will doubtless, in the course of time, be made, but with the machine under consideration a profitable success can be made, it being the most perfect as yet evolved, and it is as well for mine owners to be awake to the introduction of all labor saving devices that tend to their own profit and interest. Already twelve great American mining concerns have put in these plants, and the results have been in every case satisfactory, while a number of other coal companies are now negotiating with the same end in view. Information, catalogues, etc., will be furnished on application to the Jeffrey's Manufacturing Company, Columbus, Ohio.


THE JEFFREY MFG. CO.
COLUMBUS, O.

Automatic Expansion Gear for Steam Engines.

(Paper read before the Manchester Association of Engineers.)

In undertaking the task of preparing a paper on the above subject, to be read before the Manchester Association of Engineers, I was conscious of the great difficulty I should have in presenting anything that was novel, or that was not well known to most of the members. At the same time I was convinced that it would be interesting to have the most notable types of expansion valve gear collected and compared as to their efficiency and economy as adjuncts to the steam engine.

I will not go into the history of the subject, but confine myself to a description of the most modern forms of gear. Necessarily, I do not mention a great many well-known and efficient gears, because of the limited space and time that can be given to a paper such as this.

Before describing the mechanism for automatically regulating the supply of steam to the engine, I hope to be excused for comparing the principles involved therein, as against the method of governing the engine by throttling or reducing the pressure of steam, and the relative advantage of the former over the latter. In engines fitted with automatic expansion gear, the steam valves are so controlled by the governor as to cut off the steam from zero, up to, say five-eighths of a stroke, the cut-off taking place earlier or later, to accommodate the varying resistance to the piston's travel and the pressure in the boiler; the object is to obtain the full boiler pressure at the beginning of the stroke, maintain it to the point of cut-off, and leave the rest of the stroke to expansion. Almost all engineers agree as to the superior economy of the automatic expansion (over that of the throttling) engine, yet I do not think it strikes the majority the great saving in the expense of fuel there is, compared to those engines fitted with gear wherein the point of cut-off is invariably relative to the stroke of the piston.

In the best possible type of throttling engine, on account of the bends and passages the steam has to pass through, the initial pressure in the cylinder never attains anything like the boiler pressure. The effect of this is that when a considerable load is thrown off the engine its speed is increased; on the contrary, when an additional load is put on the engine its speed is diminished.

Now, every stroke an engine makes above its normal speed is a waste of steam, and if the engine be large, a vast waste of fuel takes place; on the other hand, a loss in speed reduces the production of a whole factory in direct proportion to that reduction of speed, the loss of one revolution in twenty reducing the capacity of every machine five per cent. A variation of one revolution in five in a throttling engine is common, and in most cases is unavoidable. There are some engineers who still think that this class of engine can compete with the automatic cut-off engine, but it is, nevertheless, a remarkable fact that they take every precaution to avoid throttling in the passages. Happily these relics of a bygone age are becoming fewer in number. If the practice of estimating the efficiency of a steam engine by its consumption of steam were more common in this country than it is at present, we should hear very little of "throttling." The present practice of estimating the efficiency by the coal consumption (involving as it does the efficiency of both the engine and the boiler), is fair neither to the maker of one nor the other.

This has been pointed out again and again by writers, and with the number of trained engineers who are capable of making such tests it is surprising that it has not become the regular rather than the exceptional practice.

I give two diagrams, A and B, illustrating a typical case, and showing the advantage following upon the adoption of an automatic cut-off gear when applied to an engine previously governed by a throttle valve.

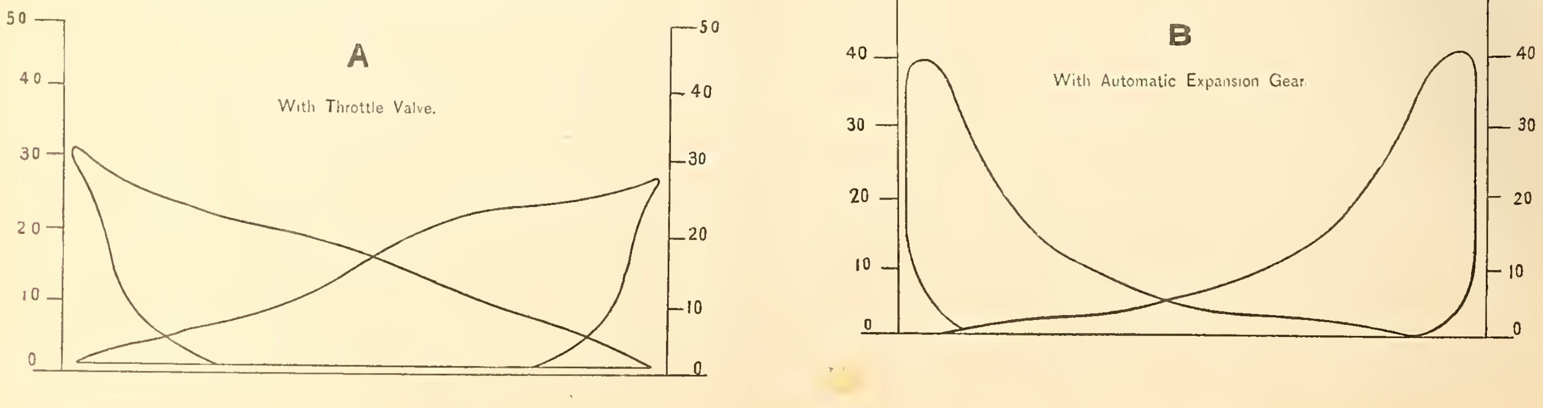
The steam consumption accounted for by diagrams, neglecting loss through radiation, etc., (which is assumed to be equal in both cases), gives a balance in favor of expansive working of about 20 per cent.

I am well aware that there are engines working and controlled by throttle valves which give low consumption of fuel, but as a rule they are working under most favorable conditions.

I lately inspected one of this class in an Oldham cotton mill, admirable in every detail as far as workmanship was concerned. Engine and boilers were new, the latter being placed as close to the engine as practicable. The consumption of fuel (common burgy) was 2.1 lb. per indicated horse power; a portion of the steam, however, was used in heating the mill, etc., so that the precise amount due to engine I could not ascertain.

HORIZONTAL HIGH PRESSURE ENGINE.

Cylinders, 20 in. dia. Stroke, 3 ft. 6 in. Speed, 50 revs. per minute.



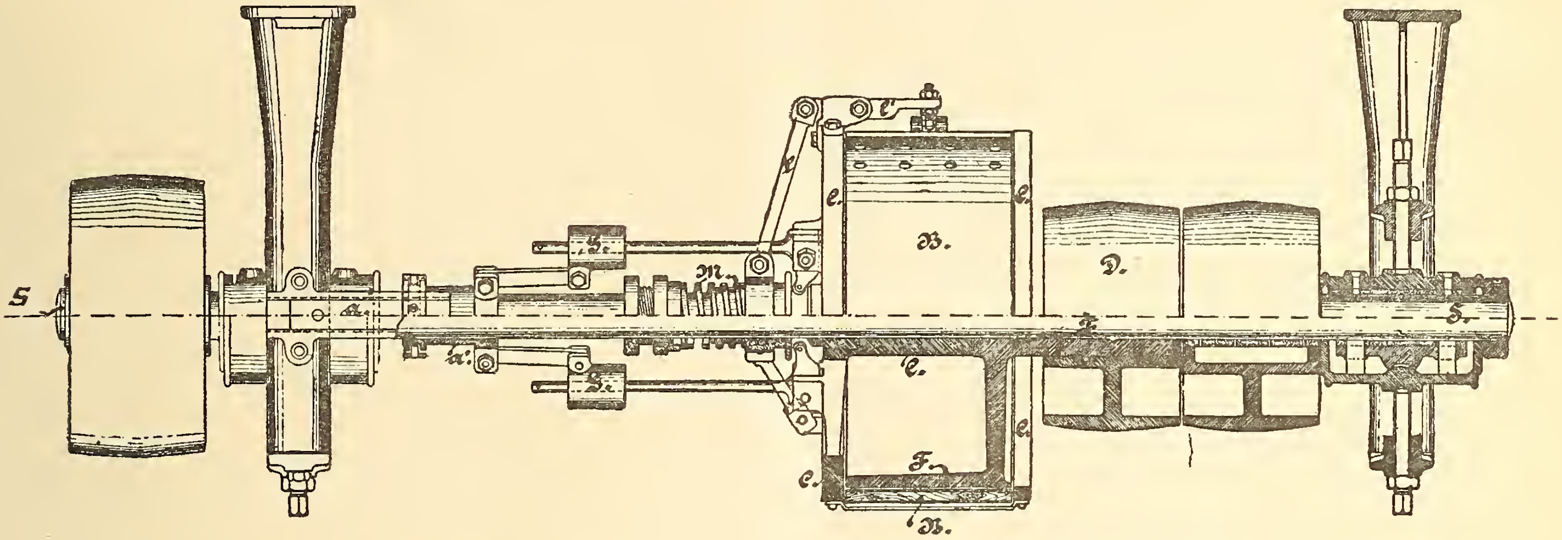
The Foote Intermediate Speed Regulator.

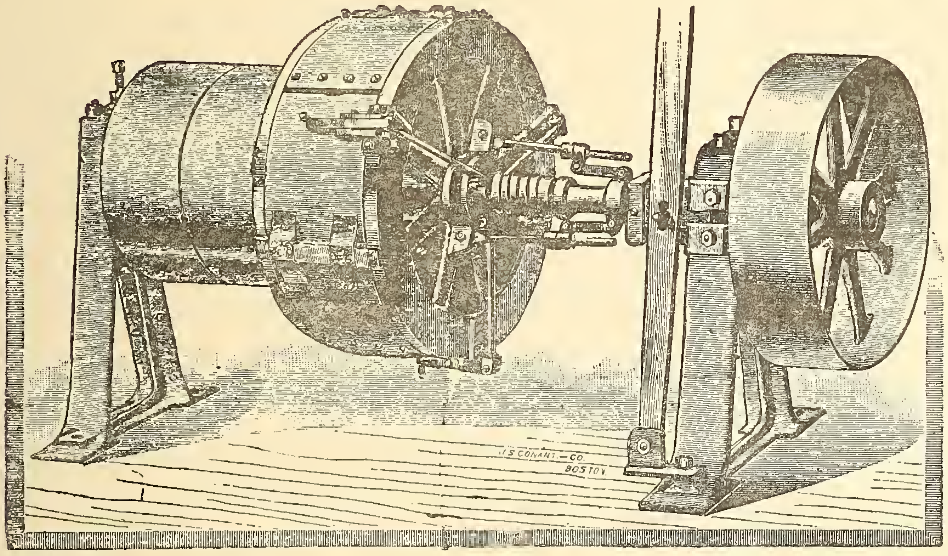
This apparatus is designed for use on line and counter shafting, to equalize the power delivered by the engines, water wheels, and electric motors ; insuring, it is claimed, an absolutely unvarying speed to electric generators, or other purposes where a very steady and uniform revolution of shafting or machinery is desired. The manufacturers especially recommend the device in electric railway works, where the variations of load are so great, causing the engines to run either above or below their nominal rated speed as the load may be greater or less, as the case may be. One application of this device, which is of special interest, is its use in connection with water wheels. It is a well known fact that there is not a satisfactory governor for water wheels in existence ; and with changing loads and different loads of water it is impossible to obtain the required uniformity and regularity of speed demanded in dynamos and electric generators. Water power promises to become an important factor in electric railway works, because of the possibilities of transmission which makes available power, which is in some cases to be obtained at a very small expense.

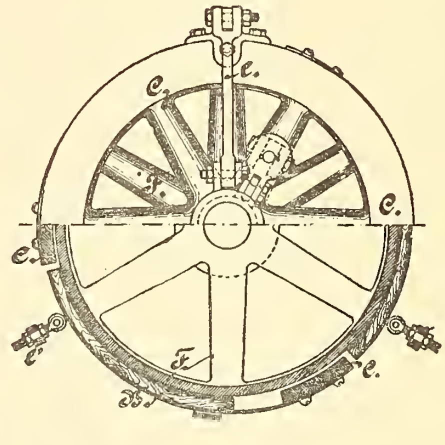
The description of the regulator as shown in the sectional view is as follows ; The main features are a friction coupling between a driving pulley and the shaft to be driven, and a governor which regulates the amount of pressure on the friction surface. As shown, the apparatus is in the form of a countershaft, D is the driving pulley, and is keyed on a projecting sleeve to which are attached the bands bearing on the friction wheel, and forming one portion of the machine. When the friction surfaces are not in contact, it is free to revolve independent of the shaft S S.

The brake shoes B, which are made of leather, backed by wood and sheet steel, are brought in contact with the friction wheel by the spring M, which acts through the levers L and L, which have their fulcrums on the carrier C, which is fast to the shaft S S. The arms of the governor G G at their fulcrums have an extension at right angle, which presses against the spring M, diminishing the pressure brought to bear on the brake shoes through the medium of the levers L and L.

The tension of the spring M and weights on the arms of the governor are determined and adjusted according to the speed and powers required. It is understood that the speed of the driven D is somewhat in excess of the speed required for the shaft S S. The arms and weights of the governor when in revolution fly outward, owing to the centrifugal force and compress the spring M to such extent as will allow of the proper amount of friction to give the desired speed. Chandler & Wittlefield, Room 40, Marine Building, Chicago, are the general Western agents.







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Pit-Shafts in American Collieries.

Mr. W. S. Gresley, M.E., in his notes on Coal and Coal Mining in North America, states that he only knows of one circular or even oval shaft, and this is in the northern district of the anthracite coal-field. Shafts are invariably made rectangular in the States. Why, the writer cannot now discuss. Brick or stone walling is never used, but timbering from top to bottom. We can only recollect coming across one single case of an arched inset or pit bottom. Wet ground is secured with solid timber cribbing, and a wall of cement is often formed behind it several feet thick. The longest shafts the writer knows are 12 ft. by 53 ft. in the clear by 1,060 ft. deep ; another (just completed) is 14 ft. by 48 ft. by 1,160 ft. deep. These are anthracite shafts. They are divided into six compartments, viz.:—Four cageways (for two pairs of winding engines), a pump division, and an air or fan compartment. Three or four compartments, however, are usual—namely, two for cages, one for fan, (bratticed off of course), and one for the pumps. Double deck cages are never used, and one tub or car only is hoisted at a time, but the capacity of the cars is very large, from 1 ton in thin seams to 4 tons, or say, 160 cubic feet in thick workings. Steam locomotives are often employed for hauling trains on the main roads, along tunnels (drifts, stone headings, cruts, etc.), and on surface between pit-tops, mouths of inclines or footrills, called "slopes" here, and the "breakers," a breaker being a huge timber building containing crushing and screening and washing machinery for preparing the anthracite for market. These locomotives are of the saddle-tank type, and usually have 9 in. cylinders by 14 in. stroke, and weigh 8 to 9 tons in running order. They are considered equivalent in effective work to from fifteen to twenty large mules, according to varying conditions of work and place. The gauge of track is from 3 ft. to 4 ft. From ten to twenty-five cars are hauled per trip, equal to from 25 to 100 tons load. Coal is the fuel consumed. Average speed about six miles per hour. The air is, of course very much vitiated where locomotives are used, but their use is restricted to places where foul air is passed direct to the returns. Electric locomotives and rope haulage are gaining favor gradually.

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Foaming in Boilers.—When boilers are new and first used, they are liable to foam, in consequence of grease or oil left in them during their manufacture. The simplest remedy for this is to put from one-half to one pound common washing soda in the boiler when first filled with water. After steam has been raised and the soda has neutralized the oil and grease, draw the fires, and when the pressure of steam has become reduced to not exceeding five pounds, blow out of the boiler, then fill with fresh water, adding a very small quantity of soda to neutralize any grease remaining within the boiler. The general cause of boilers foaming is using the steam faster then the fires are generating it, as any boiler can be caused to foam by drawing the steam from it faster then it is generated. The remedy in this case is to close the throttle so as to reduce the quantity of steam discharged in proportion to the amount being produced, increase the fire so as to make more steam, and the quantity available for service will be in accordance, without danger of foaming. The steam gauge is a valuable guide in this matter. The more dirty the water becomes, the greater necessity of attention to the fire, as dirty water will not produce steam so readily as cleaner water.

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Cheapening of Aluminum.—Mr. Eugene H. Cowles, President of the Cowles Electric Smelting & Aluminum Co., of Lockport, stated that their new process of electric reduction of pure aluminum directly from the ore has reached such a stage as to enable them to produce metal, 98 per cent. pure, at a cost of $1.25 per pound. It is proposed to utilize the entire Lockport plant for the production of aluminum by the new process, and the capacity of the works is estimated at from ½ to ¾ ton per day. The production of aluminum in alloys of iron and copper will be abandoned at these works.

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Mr. Benjamin Ford, boiler inspector, Pittsburgh, Pa., has just patented a device which has considerable promise. He proposes to replace the present style of boilers by a tubular steam generator, which will use common coal slack for fuel ; which occupies about half the space required by ordinary boilers ; costs about 25 per cent. per horse-power less ; almost perfectly consumes all smoke, and the worst accident that can happen it will be a rupture of one of the tubes, which can be replaced quickly and at small cost by any mechanic. The fire is directly applied to the series of tubes containing water. There is no outer shell to explode ; the compactness, portability, economy of fuel and perfect safety of this invention will at once recommend it to the manufacturers and users of steam. Mr. Ford's life-long experience and study of steam power guarantee the practicability of the new apparatus.

IRON, STEEL AND HEAVY METALS.

Iron and Steel.

Montreal, January 28, 1891.—The year opened with business very quiet in both the American and British markets.

The stringency in financial matters had a very depressing effect on prices, and this was especially felt in the Scotch pig iron warrant market, in which there is usually so much speculation. In spite of the great reduction in stocks there was a steady decline in prices during 1890, and warrants, which opened at 66/ in January, closed at 46/ in December. This decline was quite unlooked for, as the natural tendency, on account of the strong statistical position of the market, would have been to increased values.

The strike of the blast furnacemen in Scotland still continues, and at present there are only six furnaces in operation, out of a total of 140 built.

The following statistics, taken from Messrs. Jas. Watson & Co's. yearly report of the pig iron trade for 1890, will be of interest, as showing the large falling off in production and stocks during the year:—

Scotland.	1890. — Tons.	1889. — Tons.
Stocks in public stores and makers' yards, 1st January	1,035,840	1,244,433
Production of pig iron	798,333	998,928
	1,834,173	2,243,361
Consumption and export of Scotch pig iron	1,220,728	1,207,521
Stocks 31st December, (tons)	613,445	1,035,840

Showing a decrease on the year in stocks, of over 400,000 tons.

This points to higher figures in the immediate future. How this will affect business with Canada is difficult to say, as within the past few years a new factor has come in, which promises to have a great effect on our market in future. There is the production of American pig iron, which is finding a ready sale in Western Ontario, where on account of more favorable freight, it can be laid down very often at a lower figure than Scotch. This will likely continue, as American furnaces are, to-day, turning out more than their own markets demand, and prices in consequence keep extremely low. In Eastern Ontario and Quebec, Scotch iron still competes favorably with American. Stocks are not at all large, and Summerlee is quoted at $23.50 to $24 ex-yard, Montreal. It is not expected that prices will be any lower on the opening of navigation.

The Finished Iron trade is quiet. Canadian manufacturers are quite able to supply the demand for the ordinary quality of bars. The iron turned out by the Montreal, Hamilton and Toronto mills is of excellent quality, the material used in its manufacture being well selected.

Prices of sheet iron and hoop iron continue weak in sympathy with the general market.

On account of the large importations of tinplates into the United States, which will continue until the new tariff comes into operation on 1st July, 1891, the market has kept very firm for some time, and prices are still high. In this connection it is interesting to note that the United States took 6,253,000 boxes last year out of the total exports of 8,343,000 boxes from England. It is difficult to say what effect the altered tariff will have on this industry, as there does not seem to be any haste to start the manufacture of tinplates in the United States.

Montreal, January 28, 1891.—All reports from abroad emphasize the unsatisfactory and lifeless condition of the iron and steel trade at the opening of the year, and in any suggestions of an early improvement it is to be feared that the wish is the father of the thought. In the almost total absence of actual transactions, quotations can be considered as only nominal, and whilst in the present moderate demand buyers could probably secure further concessions, it is equally apparent that if any large demand should set in, buyers would by no means have matters their own way—in fact there is every ground for believing that it will require but a very slight general improvement in the demand to cause a very considerable rally in values. Nothing can be more eloquent in this regard than the fact that the stocks of pig iron in store in Glasgow, which on Dec. 31, 1889, were 1,035,840 tons, were on Dec. 31, 1890, only 613,445 tons, showing a decrease of 422,395 tons ;the reductions have since continued at the rate of 5,000 tons per week. An important factor in the continued dulness of the trade is to be found in the serious strikes in Scotland, which are having a most disastrous effect. The new steel-works of the Calderbank Co. expect to be in operation early in the Spring, and will prove an energetic competitor for the Canadian trade, the value of which appears to have been undervalued by some of the other Scotch steel-works, to judge by the unsatisfactory and dilatory execution of orders in the past. It is expected that the demand for steel rails for Canada will be somewhat in excess of last year, and some important enquiries are already in the market. We quote: 25 lb. steel tee rails f.o.b. Liverpool, £7 2s. 6d.; 40 lbs. ditto. f.o.b. Bristol, £5 15s.; 56 lb. ditto. f.o.b. Liverpool, £5. On the whole the import trade is about as dull as it can be in January, buyers preferring to await developments on the other side; added to this is the uncertainty as to possible changes in the Customs duties which always unsettles trade so seriously at this time of the year.

There are rumours and reports of various changes which may or may not be made; amongst others it is known as a fact that the Canadian makers of wrought iron pipe are making strenuous efforts for a change in the duty on this important article, although it now has to pay a duty of somewhat over 60 per cent.

A great deal of inconvenience is being caused to importers by the ice blockade of Antwerp, the port having been officially closed since about Christmas, and a large quantity of goods for Canada are lying there awaiting the re-opening of the navigation.

Scotch Pig Iron Warrant Market. — Below is given a comparative table of the position of the Scotch warrant market.

	1891.	1890.	1889.	1888.	1887.
Scotland.					
Price of Scotch warrants, Jan. 13	47/-	61/9	41/1½	41/4	47/2
Furnaces in blast in Scotland, Jan. 13	6	88	78	84	75
Quantity of iron in public stores	579899	925352	1032485	942782	841211
Shipments of Scotch pig iron for week ending Jan. 10	3986	8288	6050	5686	9215
Do. since beginning of year	6508	19351	19119	17976	23104
Middlesboro' iron imported at Grangemouth, week ending Jan 10	3588	2480	2554	5408	6110
Do. since beginning of year	6133	7320	16459	12368	17898
Cleveland.					
Price of Middlesbro' No. 3, warrants on Jan. 13	42/3	61/6	33/5	32/-	38/9
Furnaces in blast in Middlesbro' district	101	103	98	95	85
Quantity of iron in public stores*	120148	184815	254931	348833	317230
Shipments of pig iron from Middlesbro' for week ending Jan. 13	11565	13080	9472	10269	8155
Do. since beginning of year	16466	21709	25292	21955	17269
West Cumberland and North Lancashire.					
Price of hæmatite M/Nos. warrants	52/11	78/1½	44/3½	43/7	51/3
Furnaces in blast in W. Cumberland and N. Lancashire	50	56	49	51	47
Quantity of iron in public stores†	210813	382902	421835	411839	248557
Shipment of hæmatite iron for week ending Jan. 13	7805	9309	9925	9578	7845
Do. since beginning of year	14260	31780	25339	24986	18259

* Connal's & N. E. Rly. Co's.

† Workington, Maryport, and Barrow.

Cleveland, O., January 28, 1891.—Two questions are agitating the iron market at present. To what extent will the ore business be affected by the depression in business, and to what point will ore prices fall ! As regards the first, it may be possible to arrive at some conclusion, for the continued idleness at the furnaces implies a corresponding reduction in activity in the ore regions. Thus if the furnaces should not go into blast again until the end of March, the cutting off in the ore supply would not be less than a million tons, and this is only a fraction of the reduction that may be expected in the season's output. Bearing in mind the large quantity left over last year, some conclude that the figures for 1891 will be about six million tons, while others again, and not without reason, prophesy still smaller production. One thing is certain, namely, that much less ore will be received this year than last, and it will be sold at a much closer profit margin. All interested agree that the stability of the market depends upon economic production and close profits. There must be cheaper ore, cheaper transportation by water and rail, cheaper coke, and possibly cheaper labor. The last named point may be the easiest to settle as the skilled mechanics employed in the iron trade will much prefer a slightly lower scale with steady employment to a higher scale coupled with idleness. The ore men are willing to make every reasonable concession, and the vessel interests will, it is presumed, fall into line. The railway situation will take care of itself, the decrease in the freights serving as a convincing argument in favor of a reduction in the tarift, while the coke syndicate is at this time unpleasantly realizing the force of the long standing demands at the hands of the furnacemen. Pig iron is to be had in plenty, at very low quotations, nearly every one of the furnaces that went out of blast having large stocks on hand that they are anxious to sell. Manufactured iron has dropped off a trifle, and both sales and prices are weaker in all the lines. Prices are nominally steady.

Specular and Magnetic Ores.		
Bessemer	66@69%	$6.00
"	60@64%	5.00@5.50
Non Bessemer	66@69%	5.00@5.50
" "	62@65%	4.50@5.00
" "	57@60%	3.75@4.25
Soft Hematites Dried at 212°		
Bessemer	62@65%	$4.75@5.25
"	58@61%	4.25@4.75
Non Bessemer	55@63%	3.50@4.25

Above prices are for deliveries on docks at Lake Erie ports.

Lead.—The offerings in New York have been rather heavy, and the desire to sell on the part of the refiners somewhat marked, the market therefore inclining downwards. English consumers have shown a great deal of reluctance to buy even at the low prices and the market closes at about 4.30c, at which the last sales were reported. It is not probable, however, that values will go much lower, as the position of lead continues to be a sound one, and a rally is likely to set in as soon as buyers come into the market to supply their wants, and that seems not far distant.

The London market has also declined recently—Spanish being quoted at £12 15s. and English at £13.

At St. Louis the market has been sagging off, with few transactions and closing dull at about 4.10c.

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Iron Trade Prospects.

(From the Colliery Guardian.)

With the statistics of production of some of the chief districts producing iron in the United Kingdom, and the Board of Trade returns for the past year before us, there are some indications of the course of trade during the last twelve months which throw some light upon the immediate prospects of business. There has been the highest production of pig iron known in the history of the Cleveland district, but that in Scotland—in consequence of the strike there—has been the lowest for many years. And in both the stocks that had previously accumulated have fallen—very considerably in the case of Scotland, so that the makers have reduced the amount of dead stock that they have held. The Board of Trade returns are rather different, for they show that there has been for the past year an increase in the total tonnage of iron and steel that has been exported, but for the latest months of the year there has been a falling off, so that the higher figures of the earlier months have not been maintained later in the year. For the year, moreover, two important branches of the trade show decreases in the exports—though not to any very serious extent—and in both instances the decreases are heavier in ratio in the last month of the year. It is quite evident that there has been in the latter part of 1890 an alteration which, if it were continued, would considerably affect the iron and steel trade of the kingdom. The home consumption of iron is proved to be large, because without so extensive a consumption the stocks would not have decreased in the manner that they have done. And for the present that large local consumption seems likely to continue in the total, though it is quite probable that some of the constituent trade items may experience a change. The shipbuilding trade, for instance, has not so bright an outlook and without the placing of new orders for ships in the course of a few months, there will be a diminution in the amount of iron and steel that that industry will use.

But the weakening element in the iron trade—the enormous stocks of pig iron that had accumulated—has been further and considerably lessened, and to the extent of the reduction, it is certain that the position of the iron trade is much better. There are as yet no signs of the conclusion of the long strike in the crude iron trade of Scotland, and whilst the production of that country is almost completely suspended, it must be expected that the stocks in other districts must continue to fall. The price has certainly not made the movement in the market that had been expected, but on the other hand, it will have been noticed that the realised price of pig iron in Cleveland has certainly advanced for the last quarter of the past year in a very satisfactory manner. What the future may bring in this respect cannot be said, but the action of the Cleveland ironmasters having to claim a reduction of 12½ per cent. in the wages of the miners, must be looked upon as one of the indications that cannot be considered a good augury. The market price of pig iron, however, has fallen in the time of financial trouble much more rapidly than the cost of production, and the Cleveland ironmasters evidently intend to alter this in some degree. The iron trade, as a whole, is as yet in a very languid condition, and it is impossible to say how it will turn—though, since the publication of the Board of Trade returns, and those of the iron trade in the two great centres we have named, the disposition has been to take a more favourable view of the prospects, both of the trade as a whole, and especially as regards the prices. It is growing evident that the active condition of the coal trade is likely to preclude any reduction of moment in the price of coke, and thus the producers of pig iron must either look for lower cost of production in some other way than in that of the fuel, or they must try to have the price of their products in some way increased. The reduced stocks would give some ground for the latter, if the demand continues as large, but with a possible shrinking in the demand for ship-building purposes, it is likely that, at any rate, the reduction in the stocks will not be so rapid in the future as it has been in the past. Still, there is no likelihood just now of increase in the production, except when the long strike in Scotland approaches its close.

How far the demand may be maintained for iron and steel from other countries is a question of some importance. We must expect that after current contracts have been concluded less will be sent to some of the South American countries, which have for the time being in a large degree exhausted their credit. But there are counter-balances that are very probable. Orders for rails have been booked from countries that have been for some time out of our market, and should the raw material be maintained here at a low price such orders may be repeated, for the difference between the value of labor here and in some of the Continental countries is being reduced now—to our probable benefit. Australasia is again more prosperous than she was; and is likely to take more iron for railway and allied purposes from us in one form or other; and over the world generally, though the shipbuilding demand may be less, the demand for railway purposes shows signs of growth, though it may be that for some of the countries we may only receive the orders for iron and steel in their earlier stages of manufacture.

On the whole, we are not inclined to take a pessimitsic view of the prospects of the iron trade, though undoubtedly the industry will need to have some alteration in costs to fit it to meet the change in the views of the buyers as regards price. In most countries there has been a very large circulation of money, and that circulation means fuller employment for steamships and for railways, larger constructive works and an increased consumption of pig iron. As the price is made more reasonable, the ultimate tendency is towards increased sales, and with the reduced stocks that there are now at the greatest of our producing centres, there will be in all probability for some time to come a large production, which will not be deterred by the fact that money is now cheaper and more plentiful than a month or two ago.

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Blast Furnaces.—Of the 128 charcoal blast furnaces in the United States, 61, with a weekly capacity of 12,459 tons are in operation, and 67, capable of turning out 9,262 tons weekly, are out of blast. Of the anthracite furnaces, 102 with a weekly capacity of 41,952 are in blast, and 60, capacity 19,316 tons, are out of blast, and of 242 bituminous or coke furnaces, 143, producing 109,870 tons weekly, are in operation, and 99, with a product of 57,484 tons are out. Thus of a total of 532 furnaces of all kinds, with a weekly capacity of 250,343 tons, 306 producing 164,281 tons are in operation, and 226, capable of producing 86,062 tons, are out of blast.

Profits of American Iron and Steel Companies.—Whatever other particulars may be given to the world, the profits of manufacturers are with, very few exceptions, an unknown quanttty. The subjoined table of the profits of certain American iron and steel companies have been compiled by a Mr. Dale, who guarantees their exactness:

FIRM.	CHIEF PRODUCT.	TURN-OVER. Tons.	PROFITS IN 1890. $
Pennsylvania Forge	Muck iron	8,000	24,000
Chess, Cook & Co	"	9,600	45,000
Clinton Mill	"	8,500	35,000
Pittsburgh Forge & Iron Works	[Railway supplies	20,000	50,000
Elba Ironworks	Muck bars	28,000	65,000
Keystone Mill	"	36,000	100,000
Millvale Mill	Skelp, etc	30,500	140,000
Republic Ironworks	Iron	64,500	175,000
Vesuvius Mill	"	42,000	100,000
Soho Mill.	Iron & Steel	45,000	450,000
Sligo Mill	Iron plates.	31,500	100,000
Lindsay & McCutcheon	Muck bars	32,000	100,000
Painter, Sons & Co.	"	77,000	200,000
Zug & Co.	Iron	45,0 0	144,000
Lloyd, Sons & Co	Various iron	20,000	150,000
Solar Works	Iron & Steel	31,000	100,000
Brown & Co	"	29,000	300,000
Howe, Brown & Co.	Steel	15,000	400,000
Shoenberger & Co	Iron & Steel	48,000	750,000
Singer Nimick & Co	"	28,000	500,000
Spang, Chalfant & Co	Iron pipe.	37,700	800,000
A. M. Byers & Co	Pipe, etc	40,000	900,000
Park Bros. & Co.	Fine steel	83,500	2,000,000
Oliver Iron & Steel Co	Iron & Steel	100,000	1,500,000
Jones & Laughlins	"	120,000	2,400,000
Carnegie & Co	"	550,000	5,000,000
Linden Steelworks	Steel	20,000	400,000
Miller, Metcalfe & Parkin	"	15,000	500,000
La Belle Steel Mill	"	7,500	150,000
Spang Steel & Iron Wks.	"	30,000	600,000
Glendon Spike-works	Spikes	25,000	125,000
Pittsburgh Tubeworks	Tubes	15,000	450,000
Pennyslvania Tubeworks.	"	70,000	2,000,000

Allowing that these figures are even approximately correct, the prosperity of the American iron and steel manufacturers must be a cause of envy in other less fortunate producing centres.

Coal Output of Europe.—An interesting comparison of the output of coal in the last thirty-five years from the four great European producing countries of England, Prussia, France and Belgium, together with the number of men employed, and the number of tons raised per man, is afforded below:

Total and average annual per capita output of coal in different countries.

	No. of men employed.	Tons of coal raised. 1 = 1,000	Tons raised per man employed.
GREAT BRITAIN—			
1855	242,719	67,711	278
1860	275,847	84,042	305
1865	315,451	99,720	316
1870	350,894	114.681	326
1875	535,845	135,439	252
1880	484,933	149,320	308
1885	520,632	161,901	311
1889	563,735	176,916	314
PRUSSIA—			
1855	55,544	7,740	121
1860	64,185	10,124	157
1865	85,514	18,592	217
1870	107,703	23,401	217
1875	160,462	33,520	209
1880	156,125	42,273	270
1885	193,948	52,977	273
1889	198,363	59,583	300
FRANCE—			
1855	54,322	7,453	137
1860	59,240	8,304	140
1865	78,735	11,600	147
1870	85,357	13,330	156
1875	108,921	16,957	155
1880	107,236	19,367	185
1885	101,616	19,511	192
1889	104,932	22,952	198
BELGIUM—			
1860	81,675	10,057	128
1865	82,368	11,840	144
1870	91,993	12,697	138
1875	110,720	15,011	135
1880	102,930	16,866	163
1885	103,095	17,437	169
1889	103,477	19,205	185

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Improvements in Steam Hammers.—In Chemnitz, the great tool making center of Germany, there have been made some improvements in steam hammers that are worthy of notice, and in keeping with the tendencies of other steam machinery of our days. The hammers have two cylinders, and two piston heads of different area, that operate on the principle of a differential engine; the steam, acting first in the small cylinder to raise the hammer, is then exhausted into the large cylinder, to make the down or working stroke. Heretofore steam hammers have been wasteful machines, the steam being use without expansion, and the clearance in short strokes being lost. The differential plan seems a good one, if there are also arrangements to use initial steam both above tthe and below the piston when required.

◆

The McKinley Tariff and the Sheffield Trade.—The quarterly returns compiled from official information, as to exports from the Sheffield district to the United States of America, prove that the cutlery manufacturers of that town have been very severely hit by the largely increased duties imposed by the McKinley Tariff Act. The total value of cutlery shipped from Sheffield during the last three months of 1890 was only £28,178, as compared with £74,970 in the previous quarter, and £62,350 in the corresponding quarter of 1889. These are comparative decreases of 62 and 45 per cent. respectively.

◆

The Standard Oil Co, have now control, it is reported, of nearly every tank steamer carrying petroleum from the United States to Europe. With their recent purchases the company's fleet now includes 21 steamers of this class, having a total capacity of 24,435,000 gallons, or enough, it is claimed, to carry in 20 trips the entire year's exports.

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The Huronian rocks have been traced by Dr. Robert Bell, of the Geological Survey of Canada, for a distance of some three miles west of the Spanish River, and to South and West are gneiss formations.

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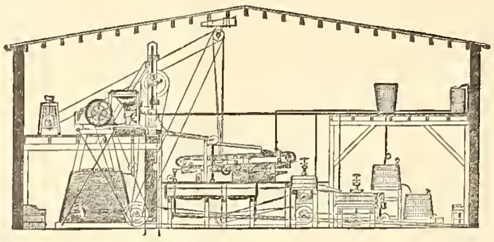

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" 20, " " 40	20c.
" 40, " " 60	30c.
" 60, " " 80	40c.
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Other Non-Com. Officers .. 85c. to 1.00 do

	Service pay.	Good conduct pay.	Total.	
1st year's service ..	50c.	——	50c.	per day.
2nd do ..	50c.	5c.	55c.	do
3rd do ..	50c.	10c.	60c.	do
4th do ..	50c.	15c.	65c.	do
5th do ..	50c.	20c.	70c.	do

Extra pay is allowed to a limited number of Blacksmiths, carpenters and other artizans.

Members of the force are supplied with free rations, a free kit on joining, and periodical issues during the term of service.

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Licenses are issued to owners of quartz crushing mills who are required to pay Royalty on all the Gold they extract at the rate of two per cent. on smelted Gold valued at $19 an ounce, and in smelted gold valued at $18.00 an ounce.

Applications for Licenses or Leases are receivable at the office of the Commissioner of public Works and Mines each week day from 10 a.m. to 4 p.m., except Saturday, when the hours are from 10 to 1. Licenses are issued in the order of application according to priority. If a person discovers Gold in any part of the Province, he may stake out the boundaries of the areas he desires to obtain, and this gives him one week and twenty-four hours for every 15 miles from Halifax in which to make application at the Department for his ground.

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Licenses to search for twelve months are issued, at a cost of twenty dollars, for minerals other than Gold and Silver, out of which one square mile can be selected for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

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The Government as a security for the payment of royalties, makes the royalties first lien on the plant and fixtures of the mine.

The unusually generous conditions under which the Government of Nova Scotia grants its minerals have introduced many outside capitalists, who have always stated that the Mining laws of the Province were the best they had had experience of.

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CANADIAN MINING REVIEW,
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MINING REGULATIONS
TO GOVERN THE DISPOSAL OF
DOMINION LANDS CONTAINING MINERALS, OTHER THAN COAL, 1890.

THESE REGULATIONS shall be applicable to all Dominion Lands containing gold, silver cinnabar, lead, tin, copper, petroleum, iron or other mineral deposits of economic value, with the exception of coal.

Any person may explore vacant Dominion Lands not appropriated or reserved by Government for other purposes, and may search therein either by surface or subterranean prospecting for mineral deposits, with a view to obtaining under the Regulations a mining location for the same but no mining location or mining claim shall be granted until the discovery of the vein, lode or deposit of mineral or metal within the limits of the location or claim.

QUARTZ MINING.

A location for mining, except for iron or petroleum, on veins, lodes or ledges of quartz or other rock in place, shall not exceed 1,500 ft. in length and 500 ft. in breadth. Its surface boundary shall be four straight lines, the opposite sides of which shall be parallel, except where prior locations would prevent, in which case it may be of such a shape as may be approved of by the Superintendent of Mining.

Any person having discovered a mineral deposit may obtain a mining location therefor, in the manner set forth in the Regulations which provides for the character of the survey and the marks necessary to designate the location on the ground.

When the location has been marked conformably to the requirements of the Regulations, the claimant shall within sixty days thereafter, file with the local agent in the Dominion Land Office for the district in which the location is situated, a declaration or oath setting forth the circumstances of his discovery, and describing, as nearly as may be, the locality and dimensions of the claim marked out by him as aforesaid; and shall, along with such declaration, pay to the said agent an entry fee of FIVE DOLLARS. The agent's receipt for such fee will be the the claimant's authority to enter into possession of the location applied for.

At any time before the expiration of FIVE years from the date of his obtaining the agent's receipt it shall be open to the claimant to purchase the location on filing with the local agent proof that he has expended not less than FIVE HUNDRED DOLLARS in actual mining operations on the same; but the claimant is required, before the expiration of each of the five years, to prove that he has performed not less than ONE HUNDRED DOLLARS' worth of labour during the year in the actual development of his claim, and at the same time obtain a renewal of his location receipt, for which he is required to pay a fee of FIVE DOLLARS.

The price to be paid for a mining location shall be at the rate of FIVE DOLLARS PER ACRE, cash, the sum of FIFTY DOLLARS extra for the survey of the same.

No more than one mining location shall be granted to any individual claimant upon the same lode or vein.

IRON AND PETROLEUM.

The Minister of the Interior may grant a location for the mining of iron or petroleum, not exceeding 160 acres in area which shall be bounded by north and south and east and west lines astronomically, and its breadth shall equal it in length. Provided that should any person making an application purporting to be for the purpose of mining iron or petroleum thus obtain, whether in good faith or fraudulently, possession of a valuable mineral deposit other than iron or petroleum, his right in such deposit shall be restricted to the area prescribed by the Regulations for other minerals, and the rest of the location shall revert to the Crown for such disposition as the Minister may direct.

The regulations also provide for the manner in which stone quarries may be acquired.

PLACER MINING.

The Regulations laid down in respect to quartz mining shall be applicable to placer mining as far as they relate to entries, entry fees, assignments, marking of localities, agents' receipts, and generally where they can be applied.

The nature and size of placer mining claims are provided for in the Regulations, including bar, dry, bench, creek or hill diggings, and the RIGHTS AND DUTIES OF MINERS are fully set forth.

The Regulations apply also to

BED-ROCK FLUMES, DRAINAGE OF MINES AND DITCHES.

The GENERAL PROVISIONS of the Regulations include the interpretation of expressions used therein; how disputes shall be heard and adjudicated upon; under what circumstances miners shall be entitled to absent themselves from their locations or diggings, etc., etc.

THE SCHEDULE OF MINING REGULATIONS

Contains the *forms* to be observed in the drawing up of all documents such as:—"Application and affidavit of discoverer of quartz mine." "Receipt for fee paid by applicant for mining location." "Receipt for fee on extension of time for purchase of a mining location." "Patent of a mining location." "Certificate of the assignment of a mining location." "Application for grant for placer mining and affidavit of applicant." "Grant for placer mining." "Certificate of the assignment of a placer mining claim." "Grant to a bed-rock flume company." "Grant for drainage." "Grant of right to divert water and construct ditches."

Since the publication, in 1884, of the Mining Regulations to govern the disposal of Dominion Mineral Lands the same have been carefully and thoroughly revised with a view to ensure ample protection to the public interests, and at the same time to encourage the prospector and miner in order that the mineral resources may be made valuable by development.

COPIES OF THE REGULATIONS MAY BE OBTAINED UPON APPLICATION TO THE DEPARTMENT OF THE INTERIOR.

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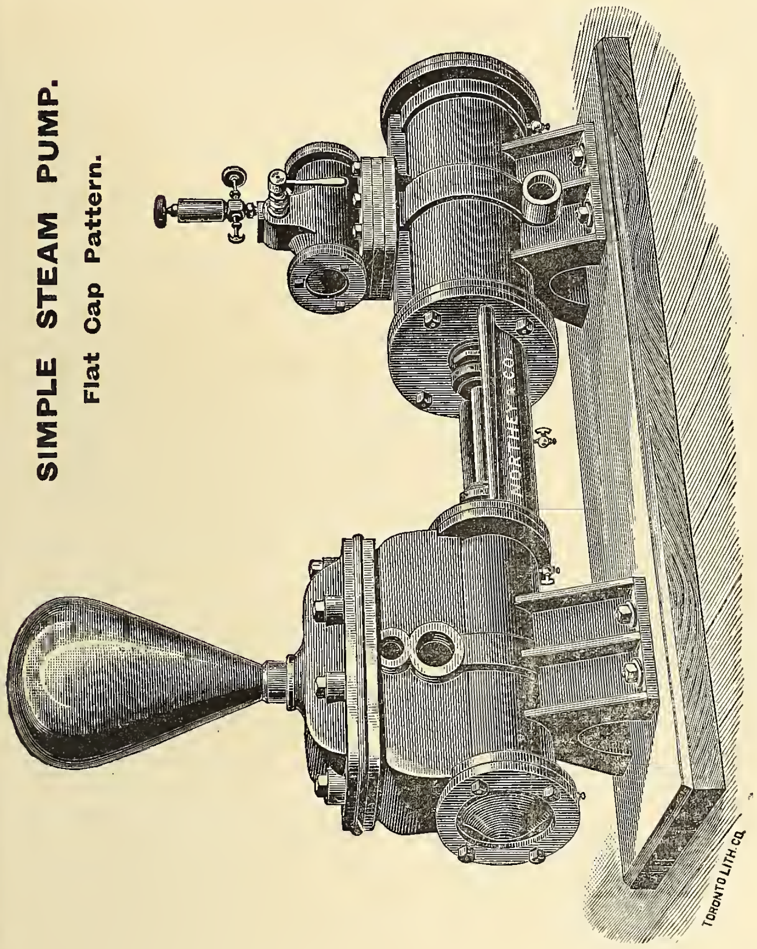

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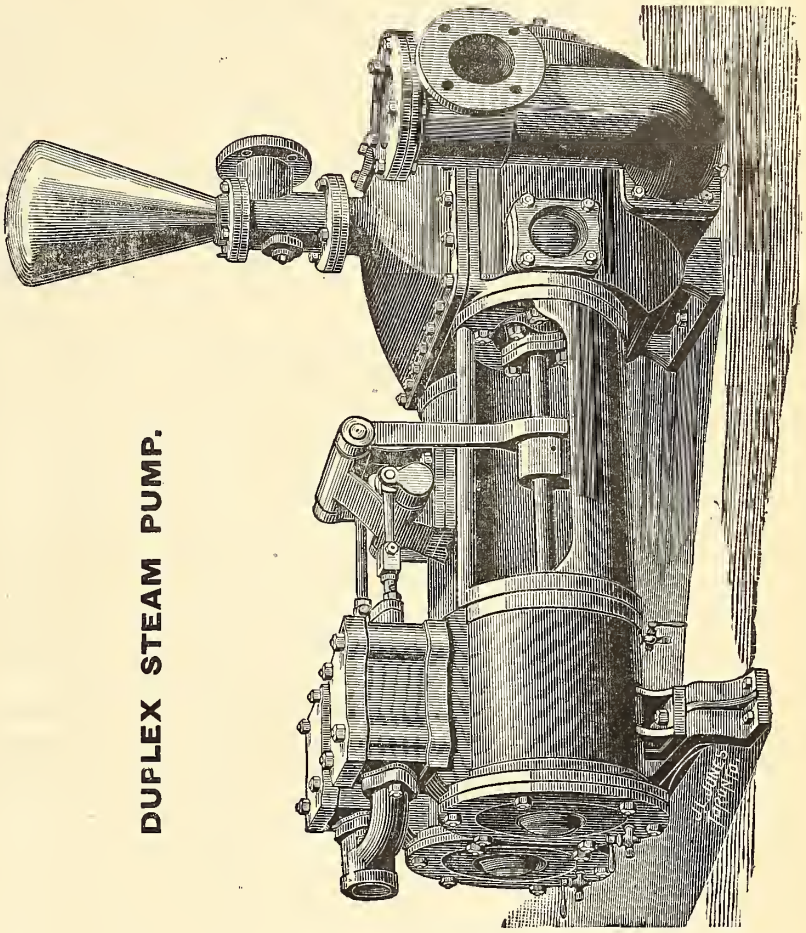

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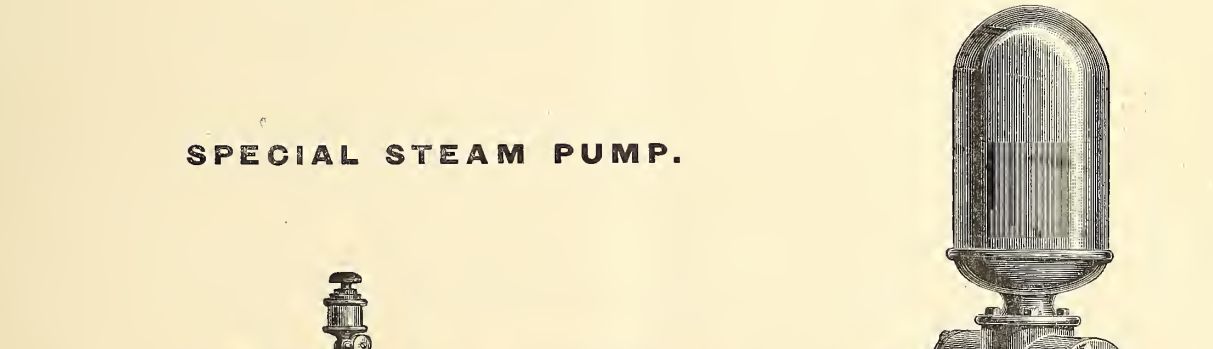

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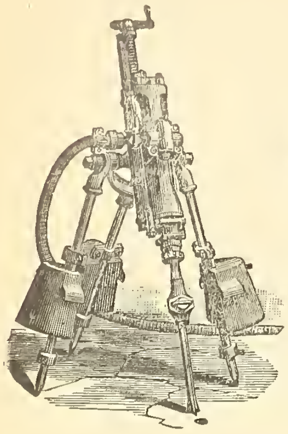

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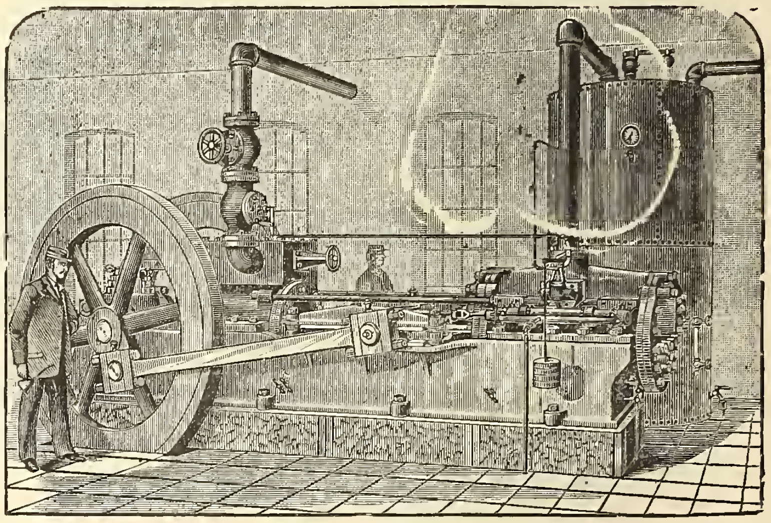

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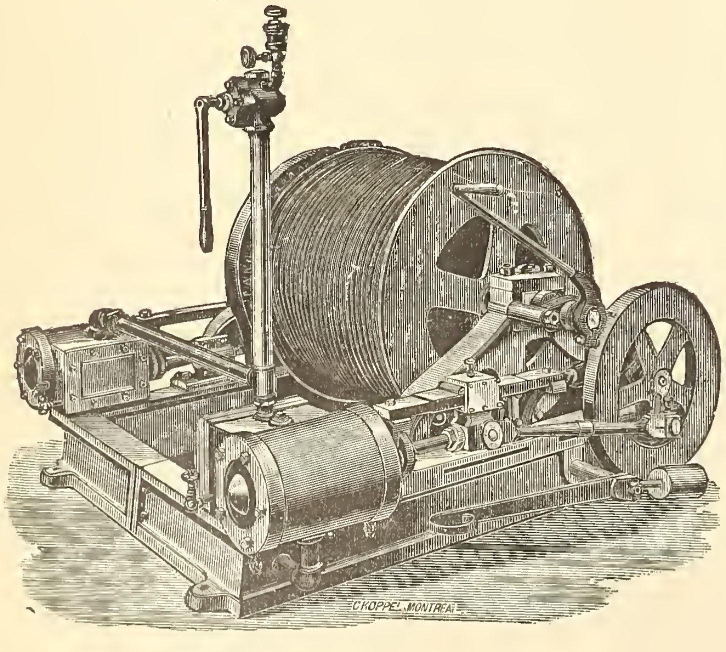

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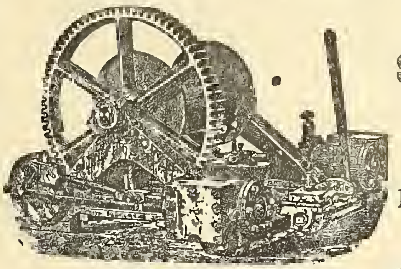

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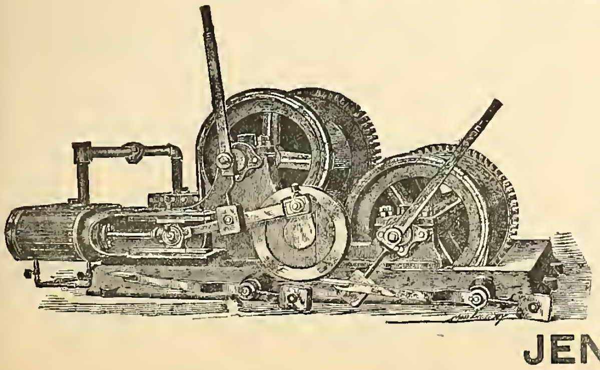

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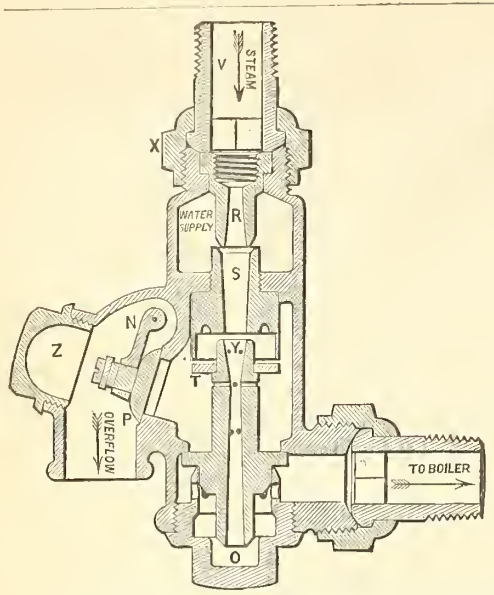

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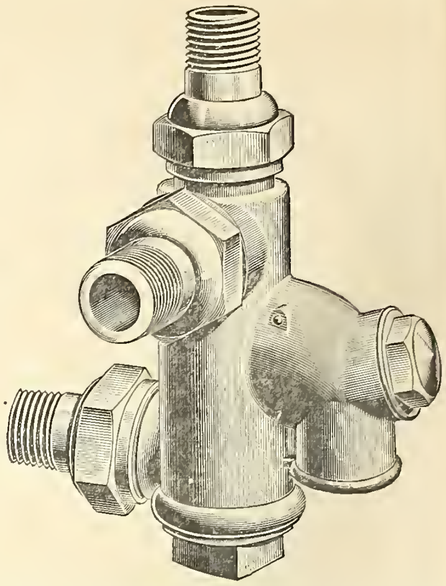

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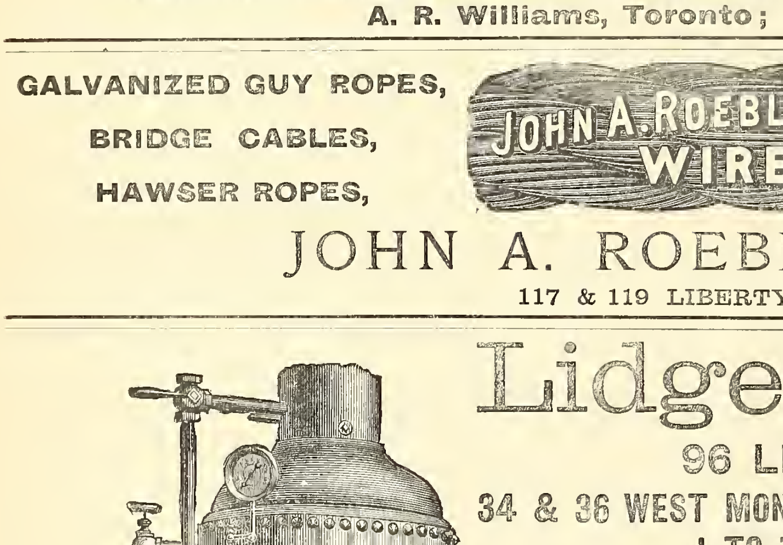

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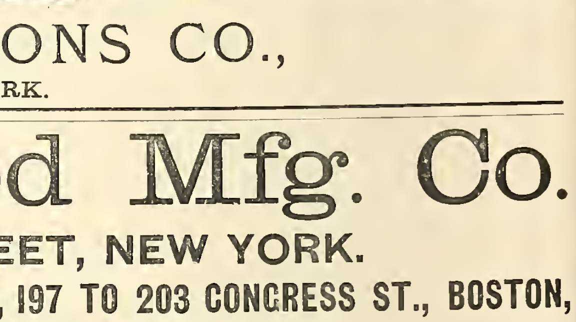

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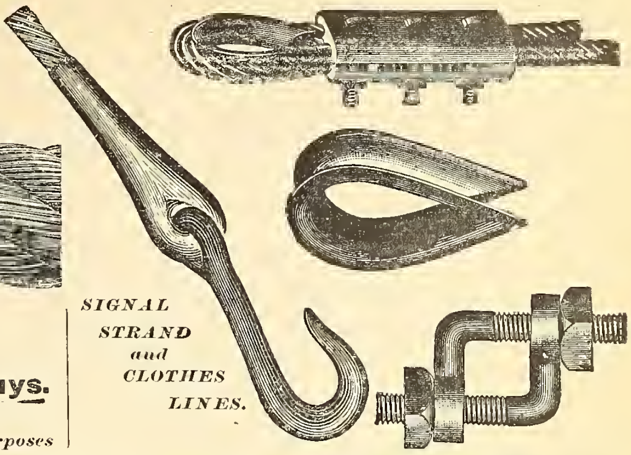

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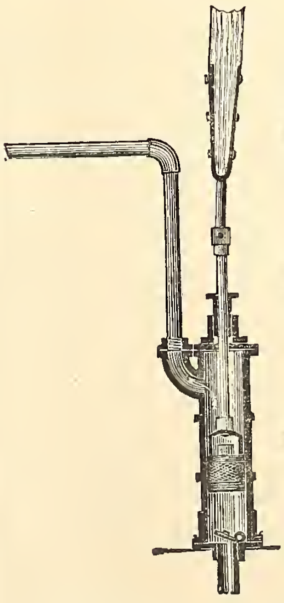

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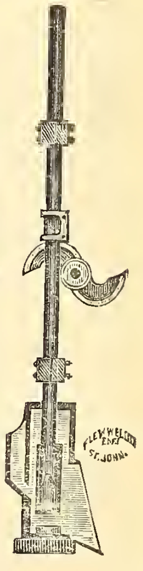

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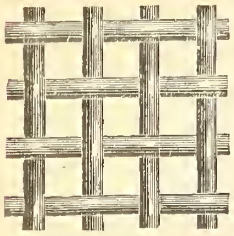

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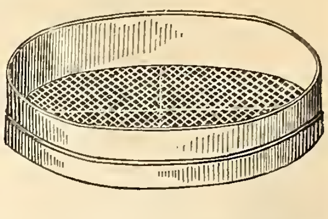

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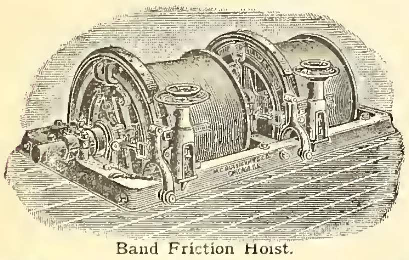

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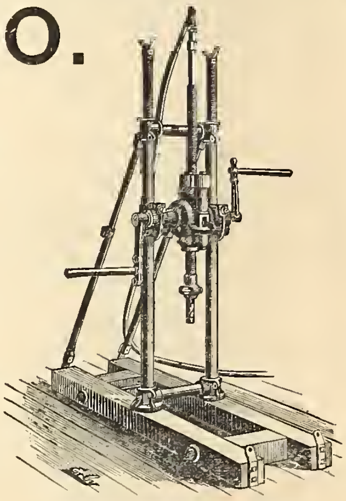

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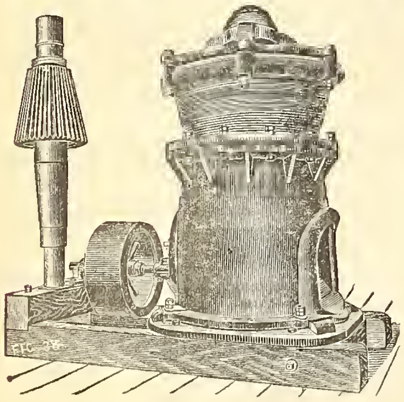

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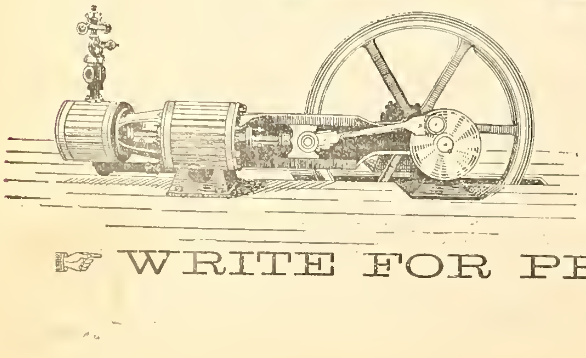

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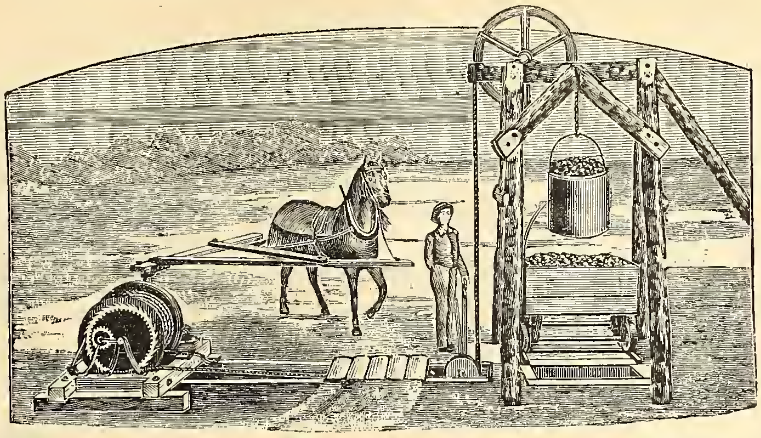

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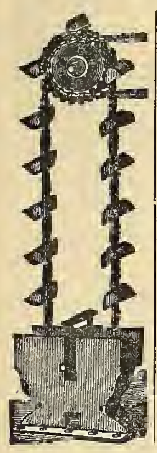

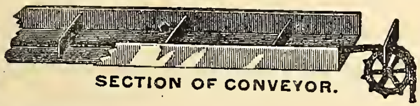

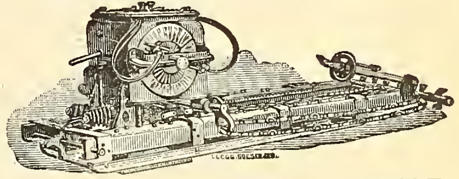

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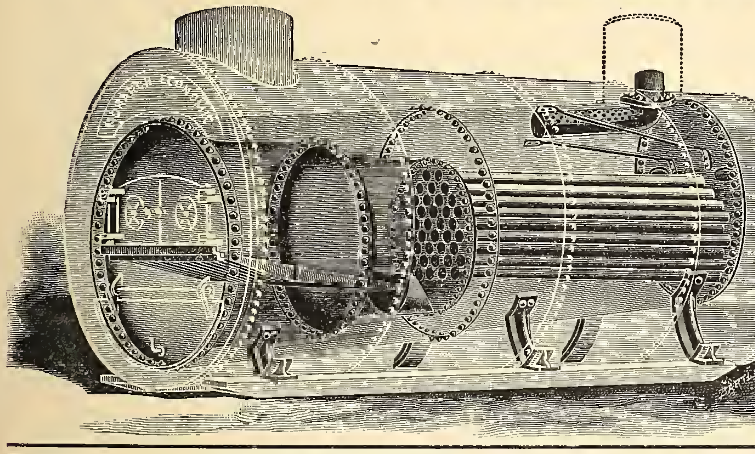

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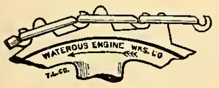
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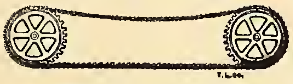

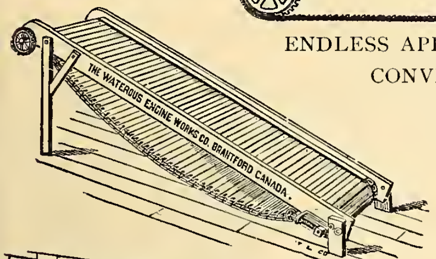
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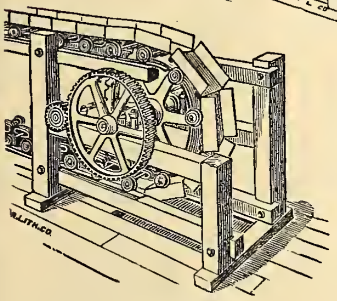

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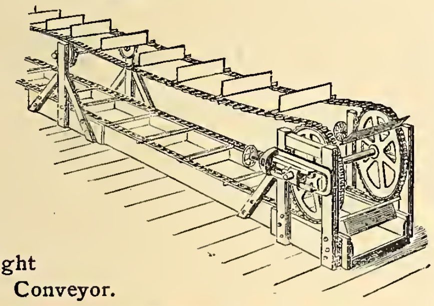

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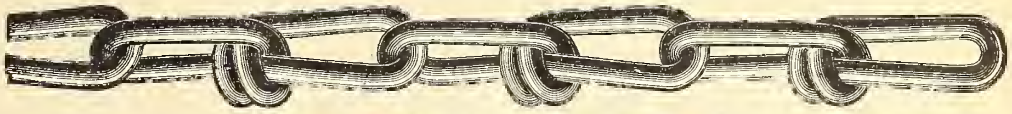

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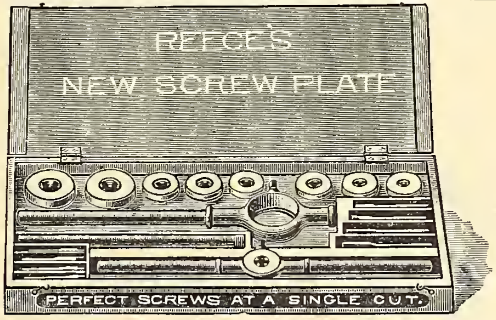
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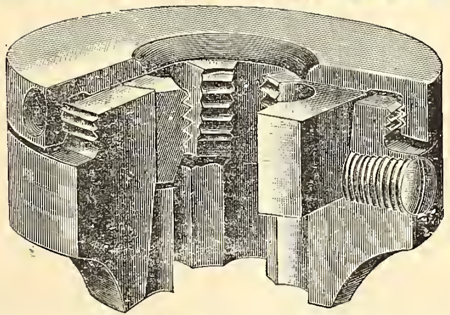

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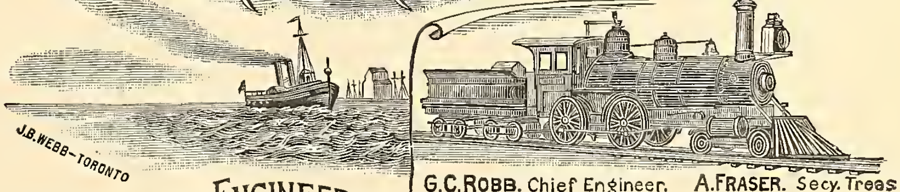

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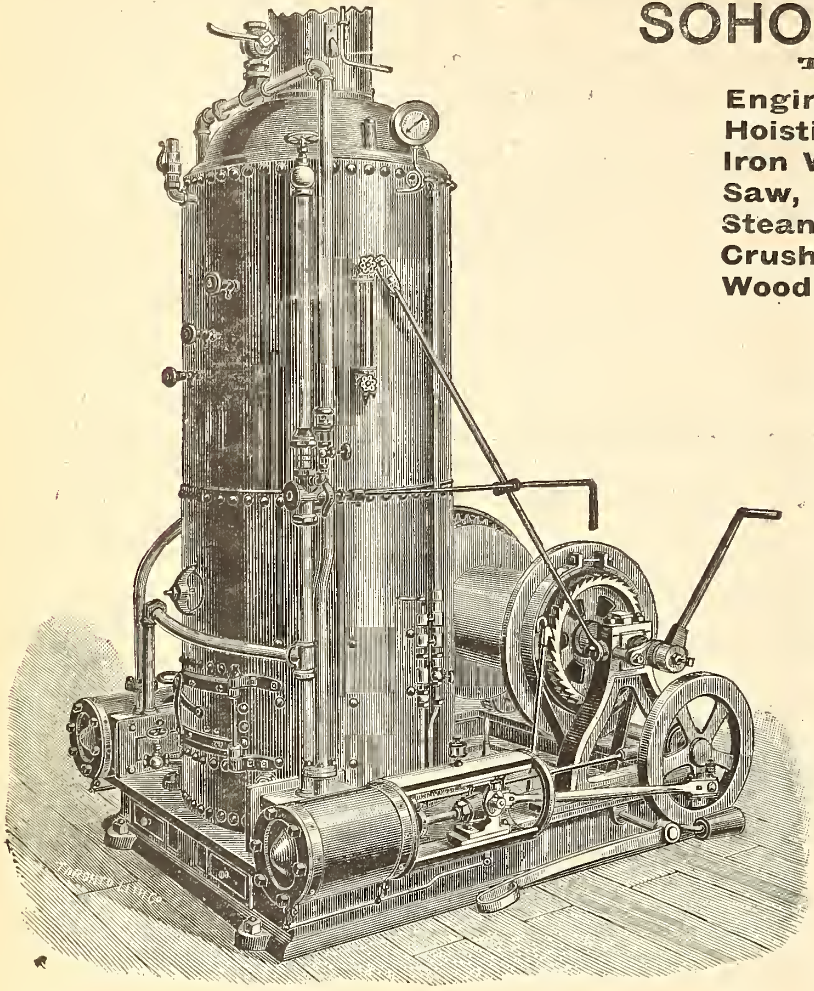

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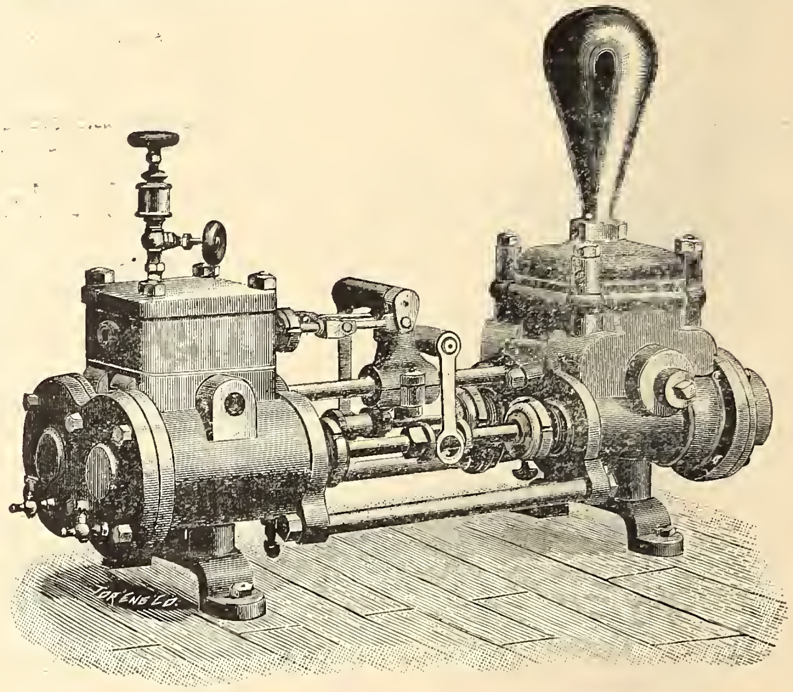

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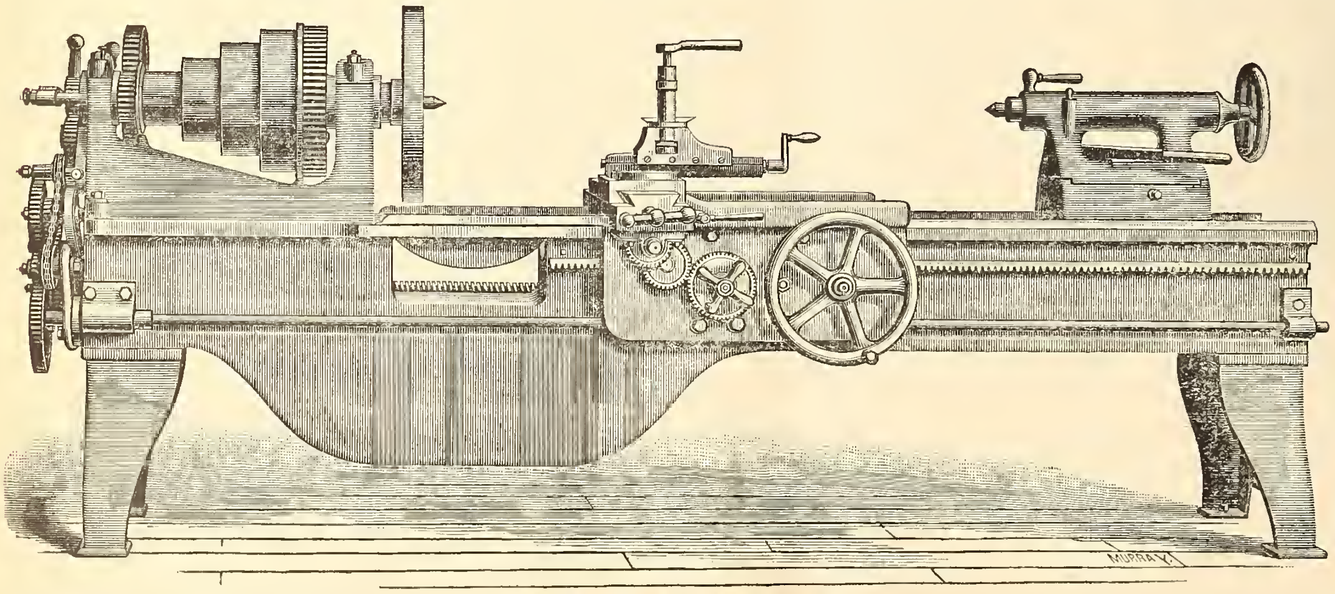

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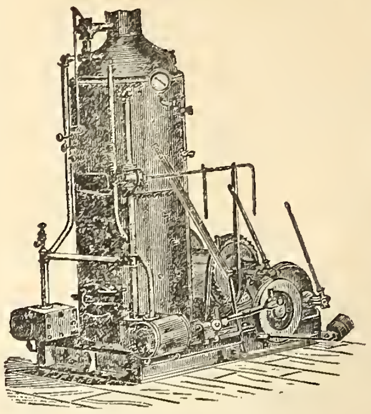

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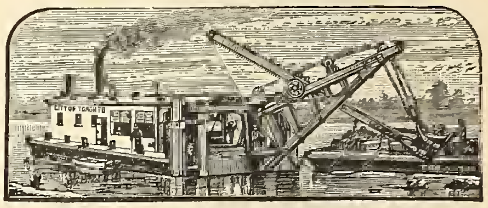

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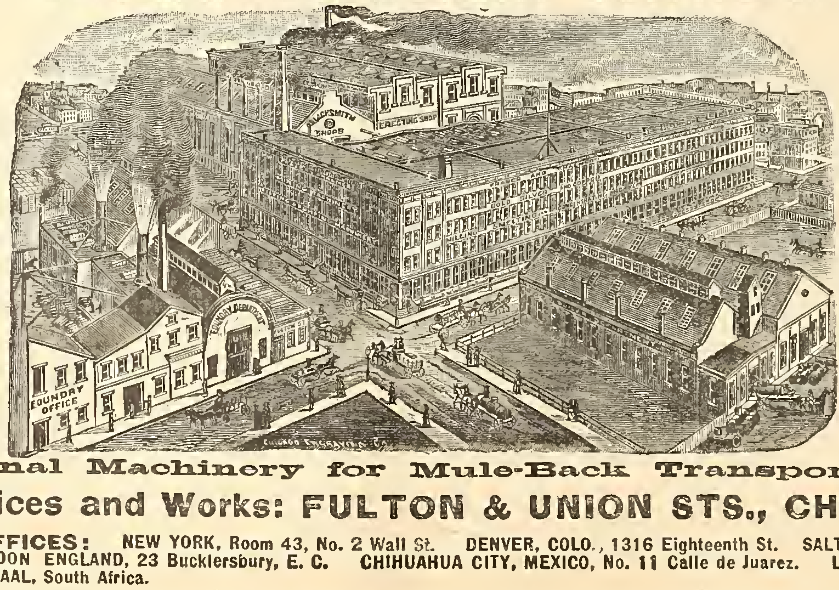

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The General Mining Association of the Province of Quebec.

The completion of the organization of this Association, at the Windsor Hotel, in Montreal, on the 30th of January, marks an epoch in the history of our mining industry. Great unanimity and enthusiasm were manifested, and the only regret was that in a body where all the members were eminently qualified for the position, it was necessary to select a limited number to form a committee of management. But the fullest liberty was given for nominations, and the elections were unanimously carried.

The attack upon the mining industry made by the Quebec Government in its eager pursuit for revenue, has produced the good effect of bringing into union all the persons interested in mines and mineral lands. The wide scope given to membership will have a favorable influence in securing breadth of view, and a pleasing variety of personality and attainment, which cannot fail to promote the effectiveness of the Association in its organized work, and the pleasure and benefit of its members. In the present condition of our mining industries, the number of professional educated mining engineers, who have collegiate authority to append the mystic letters M.E. to their names, is too small to permit of the existence of an exclusive Association of Mining Engineers, and it was wisely determined to make the membership as broad as possible.

This Association will prove of undoubted value as an organization to watch for and oppose hostile legislation, or to promote favorable legal enactment. "What is everybody's business is nobody's," the old proverb says, and it is desirable to have a representative authority to take action in the common interest when emergencies arise. Probably the action as regards legislation will be mainly defensive; for the prevailing sentiment in this respect appears to be a desire to be let alone. The miners have never lobbied for subsidies or protection, but have shown commendable independence in trusting to their own efforts in their arduous and hazardous struggle to win mineral treasure from nature's grasp. But they have almost too patiently borne the imposts and restrictions that have oppressed them in consequence of the favoritism shown by the Dominion and Municipal Governments to manufacturers, by which all their expenses have been increased without any corresponding benefit; and now that the Quebec Government has singled them out to bear the brunt of direct taxation, it is high time for them to cry, Hands off! and to declare that in this professedly free country there shall be special privilege to none, unjust infliction upon none, and equal opportunity for all.

Legal operation, whether defensive or positive, it is to be hoped will be the smallest sphere of the Association. From the quarterly meetings we may look for its greatest benefits. The chief of these will probably be the value of personal acquaintance and the interchange of ideas. Our mining interests have in many cases suffered from jealousy and rivalry, a lack of intelligent co-operation, and even the manifestation of malignant opposition. The recognition of fellowship in a common cause, which is brought about by association for combined effort, tends to the dispersion of these unworthy sentiments and to the development of a more far-sighted friendliness and spirit of mutual helpfulness. By the comparison and discussion of methods of work all parties are benefited; for it is true in mining as elsewhere, that no one has a monopoly of all knowledge; and he who overcomes his unwillingness to impart useful information to rivals, is always rewarded by return favors, and often finds himself the gainer. Our mining operations have been carried on, for the most part, in crude fashion, by so called "practical" men, whose undertakings might often be improved by the application of "skilled" knowledge. By rubbing up against one another at the meetings, they will wear off some of the angles of exclusiveness and conceit, and be rounded off for more effective service, besides expanding their humanitarianism. The reading of papers by the best talent of the country will be a valuable educational influence both to the members and, by their publication, to the country at large. Several papers by some of our most prominent scientific men have already been promised, and it is expected that at the first quarterly meeting, which takes place in April, at Montreal, there will be a great feast of reason, to be followed by a flow of soul at the banquet.

We appeal to the mining men of all conditions and capacities to unite for mutual benefit in maintaining this organization, which may be made the means of great individual culture and happiness, as well as the instrument of the country's material progress in the development of her mineral wealth. If any one has a criticism to make, or a suggestion to offer, instead of uttering it in a carping fashion in the press, let him show his genuine interest in the mining industry by joining the Association and trying to make it what he thinks it ought to be. But we believe that the gain in knowledge and enthusiasm which may be derived from membership in this Association will permit some future tales of success to be told which otherwise would never have been uttered, and that through its influence an impetus will be given to what is undoubtedly the most romantic, the most speculative, and possibly the most profitable of all pursuits—the Mining Industry.

The Interview with the Premier.

On Wednesday, the 11th instant, a committee appointed by the General Mining Association of the Province of Quebec, held an interview by appointment with the Hon. Mr. Mercier at the Government offices in Montreal. There were present Hon. George Irvine, Capt. R. C. Adams, Alderman R. Prefontaine, and Mr. B. T. A. Bell, representing the deputation, and also Messrs. S. P. Franchôt, A. H. Murphy, Major R. G. Leckie and others. Hon. Mr. Irvine reviewed at some length the legal objections to the new mining law, pointing out that it confiscated rights which had been obtained by purchase, and declared all mines to be the property of the Crown, even though the Crown had previously ceded them to individuals for a consideration. Such a revolutionary enactment, he intimated, would in all likelihood be disallowed by the Dominion Government; but before taking any steps in that direction he desired to call Mr. Mercier's attention to the matter, trusting to his sense of justice to revise the enactment.

Capt. Adams, speaking especially for the phosphate interest, pointed out practical objections to the new law. He said that if the royalty was to be collected by the original purchasers, who had bought lands at low prices from the Government, there could not be much objection, beyond the point raised by Mr. Irvine that it involved a breach of contract, but in nearly every instance the mines now working had been purchased at prices varying from $50 up to $1,000 an acre, and these prices had been paid solely on account of the assurance conveyed by the Crown patents that the title gave absolute ownership of the minerals forever. The amount of capital thus invested in the land created a heavy interest charge, and the imposition of a royalty in addition would prove ruinous to some of the less prosperous mines. Already it had checked investment in the industry, and an agent of foreign capitalists intending to invest in Canadian phosphate lands had just received a cable recalling him to Europe in consequence of this enactment. He stated that the miners approved of the principle of leasing or selling lands subject to a royalty and with compulsion of working, but would have the terms of acquisition even more favorable, so that the prospector or discoverer might be encouraged to work his finds. He further called attention to the arbitrary powers given to inspectors, and the vexatious nature of the law compelling the erection of fences around pits. The offer of half of the fine to informers he considered especially demoralizing, and likely to lead to injurious action on the part of discharged or discontented employees. Finally, he objected that the law had been framed without consultation with those engaged in the industries, who understood their requirements, and some parts had evidently been copied from foreign enactments, and were not applicable to prevailing conditions in this country.

Mr. Bell followed with statements of the injurious effect of the law in checking enterprise. The competition arising from the newly discovered phosphate fields of Florida was already a serious menace, and the imposition of burdens beyond the natural difficulties that had to be encountered would have the effect of discouraging further development of the Canadian phosphate industry.

Mr. Mercier stated that he of course desired to avoid inflicting any injury upon the mining industries of the Province, for he fully realized the importance of their growth and prosperity; but he must have more revenue, and he only wanted to see how to raise it in the least burdensome manner. He requested that a *factum* should be prepared stating briefly and succinctly all the points taken against the Bill, and this would be carefully considered by the Ministers in Council and by the Attorney-General before the law would be enforced. He denied the report that had appeared in the papers that he had refused to receive a deputation of mining men who desired to protest against the passage of the Bill.

Mr. Franchôt then asked him if it was not true that he sent a message refusing to receive a delegation, saying that discussion was useless and he was bound to stand by the Bill.

Mr. Mercier admitted that he had done so, but that it was only a few days before the third reading of the bill, when it was too late for discussion. He promised full attention to the representations made, and professed the heartiest interest in the progress of the mining industries.

The delegates agreed to present their suggestions in writing, and departed, pleased with the courtesy of their reception, and *more or less* hopeful as to its results.

Mining as an Investment.

Mining operations are, unfortunately, regarded by the general public very much in the light of a lottery, in which, by chance, a prize may be drawn, but with all the odds in favor of a blank; and little trouble has been taken to discover whether in reality, they are not as legitimate and profitable as any of those industries in which the great mass of the population are engaged. Unscrupulous company promoters have, it is true, time and again, deluded investors into buying worthless properties, but it is a question if the latter have not themselves mostly to blame for being taken in. In any ordinary commercial transaction they exercise their business sagacity, but blinded by visions of sudden wealth, forget to do so at the moment when most of all it is needed. Properties have repeatedly been bought without examination, and what wonder then, if some prove to be myths and others worthless. And yet, rightly considered and operated by practical men on a business basis, mining is a good investment, not necessarily a bonanza, but which, without more than the ordinary risks attendant on other business, may be made to yield far more than ordinary profits. The great essential, of course, is to have a good property, and with the known great mineral richness of this country, there are numbers; the second, to work it with sufficient capital to allow of proper development and necessary plant. That under these conditions, satisfactory returns may be had is evidenced by the statements of some American mining companies for the year just closed. Sixty-five companies showed a total of $13,743,748 paid in dividends, against $10,537,522 by sixty-one companies in 1889, the total dividends paid to date being $116,950,302. Of these, eight Lake Superior copper companies paid $3,415,000, an average of 8.5 per cent. Four paid over 10 per cent. and three over 13 per cent., the highest being 16.5 per cent. The total dividends paid amount to $47,187,500. Silver mines made good returns, some paying as high as 13 per cent., and nearly all paid increased dividends. Gold mining was hardly as profitable as in 1889, but three mines of which returns were received, declared dividends amounting to $357,000, and have paid to date $12,395,300 to shareholders. Among the gold and silver mining companies, profits have been enormous, one paying 40 per cent., and others between 27 per cent., and 34 per cent. The actual return based upon the total dividends ($11,475,428), paid by thirty-six companies, for the shares of which quotations have been obtained, viz., on a market value of $89,200,500, was almost 13 per cent., as against a little more than 12 per cent. on $78,111,150 in 1889. These are very high rates of interest, far higher than could be obtained in almost any other commercial enterprise. To come to our own country, many mines are paying good dividends on a limited outlay, and some, as asbestos, even large ones, and all are certain to do better year by year, as the demand enlarges. Yet how little capital is invested by Canadians in mines, as compared with the money put into stocks, and other investments such as the boot and shoe trade, in which competition has cut down profits to a minimum or to nothing at all, or in the dozens of other enterprises which might be cited, all yielding but small, and often, no returns. In the commercial world all over, it is the same; competition is such that it is difficult even to hold one's own, and three and four per cent. will soon be considered a good return on investments. In view of this it is natural that capital should seek fresh outlets, and already there are indications of a movement in the direction of Canadian mining. Foreign capital is welcome, and will help to build up the country, but it is eminently desirable that Canadians themselves should take a direct interest in this, the most promising industry of their own country, put their money in it, and—most important—reap the returns from it, that are now in great part, going out of the country. The outlook for the present year is favorable; the profits of existing mines promise to increase, and a number of new companies will commence operations, but there is room for many more, to develop the great resources of this country, not in one particular mineral, but in all.

EN PASSANT.

That energetic and enterprising body, the Port Arthur Board of Trade, have, we understand, several important amendments to the Ontario Mining Law under consideration. We hope in a future issue to submit these proposals to our readers.

In the case of Dansereau *et al.* against the Dominion Phosphate and Mining Company, the old difficulty has been experienced of collecting witnesses, and now that the general elections have been announced its termination seems to be indefinitely postposed.

The map and report on the Sudbury District by Dr. Robert Bell, of the Geological Survey, will be ready for distribution in about a month. Much new ground has been gone over, and the other parts more accurately surveyed, the geological formations have been traced, and the map will be found of service to prospectors and others in that region.

By an Order-in-Council under date of 7th February, metallic copper, the exclusive product of Canadian ore smelted abroad and returned to Canada by the producers of the ores. is to be admitted into the Dominion on payment of duty on the cost of smelting, under such regulations as may be prescribed, for one year from February last.

We are sure all our gold mining friends in Nova Scotia will join with us in heartily congratulating our good friend Mr. John Hardman, on the successful issue of his Appeal to the Supreme Court of Canada. The verdict, besides completely exonerating Mr. Hardman, passes some severe strictures on Mr. Justice Weatherbe, who improperly charged the jury, "introducing numerous discrepancies not bearing on the real issues of the case." A more extended notice of this case will be found in our legal column.

A report on the Surface Geology of Southern New Brunswick by Mr. R. Chalmers, together with three quarto sheet maps of the southeast, southwest and northeast portions of the province, will shortly be issued under the auspices of the Geological Survey. It will be accompanied by sheets showing the known localities of minerals of any economic value. The maps represent three seasons' work, 1887-88 and 89, and will be on the scale of four miles to the inch. These will be of great value, not only to miners and prospectors, but also to lumbermen and others, as on them are delineated the general configuration of the country, the extent to which it is wooded, the kinds of wood in the different localities and whether of old or new growth, and the nature of the soil, besides the geological features, which they are more particularly intended to set forth. The report itself, discusses the origin of the surface deposits, glacial phenomena, etc., and the whole work will prove a valuable addition to the literature on this part of the Dominion, of which, as yet, comparatively little is known. Mr. Chalmers was, during 1890, working on the eastern part of the province, which will require two or three seasons to thoroughly explore.

The conquest of Peru by Chili, says a gentleman who spent several years in those regions, has been a serious blow to nitrate and phosphate mining in those regions. A tax has been laid on the Peruvian mines for ten years, and operators find it more to their interest not to work them, as they can at the end of that time renew operations without the hindrance of the tax and with the mines unexhausted.

Messrs. E. Balbach & Son, the well known smelters and refiners of Newark, N.J., have incorporated their business under the laws of New Jersey by the name of the "Balbach Smelting and Refining Company, Newark, N.J.," the corporation assuming all existing obligations and contracts. The firm state that while they have found it desirable to make this change in the form of conducting their business, it is their intention that in substance the old management and character shall continue.

A Pennsylvania legislator has introduced a bill to impose a tax of 1 cent per long ton of coal mined within the State, to establish a relief fund for the benefit of persons injured, maimed or killed in the employ of individuals, firms or corporations. Such a law would be a great injustice to operators and would furnish a precedent that might be followed to dangerous lengths. If coal operators should be taxed, why should not railroads also be compelled to insure their employés? Insurance is a very delicate subject, and not to be handled lightly or disposed of by any such wholesale means as that in the bill.

We have received a copy of the report upon the work carried on in the laboratory of the Geological Survey, from the date of the previous report to the end of 1889, by Mr. G. C. Hoffmann, F. Inst. Chem. F.R.S.C., Chemist and Mineralogist to the Survey. A great deal of valuable information is contained within its pages; analyses of different ores and minerals in the various provinces have been made, the results of which are therein embodied, and will be found of great interest to the mining community.

"Electric Mining Machinery" was the subject of an excellent paper read by Messrs. L. W. and Claude W. Atkinson, Assoc. M.M. Inst. C. E., before the tenth ordinary meeting of the Institution of Civil Engineers, held in London. The authors having been constantly connected with the application of electricity to mining during the past four years, spending a considerable amount of time underground, both in experimental work, and in teaching those who would have charge of electrical machinery, arrived at the following conclusions:—

(*a.*) That electric power was destined to become an important factor in mining mechanics, on account of: (1) The facility with which it could be used with machines which required to be moved from time to time; (2) the great economy in first cost and reduced cost of working owing to its efficiency being higher than that of compressed air, or any other medium of power transmission; (3) the smaller cost of maintaining the cables, as compared with piping, on shifting floors in roadways, &c.

(*b.*) That the methods described were sufficient to obviate all objections to the use of electric motors in coal mining whether by excluding inflammable gases or by constructions which would allow of their safe combustion.

(*c.*) That the experiments, trials and practical work, extending over four years, showed that: (1) Electrical pumps might be used with advantage and economy for mine draining; (2) electrical coal-cutters could replace hand labor, with saving in cost, and increased production of coal; (3) electrical drilling machines were available in place of machinery worked by hand or compressed air.

There has been some discussion recently in England over the necessary qualifications of inspectors of mines, more particularly as to the length of time that applicants must hold first-class certificates as colliery managers before becoming eligible. This has drawn forth the following enumeration of the requisite qualities in an inspector from the *Colliery Manager*—which holds that such certificate should be held for five years before permitting of candidature—and may be regarded as the accepted opinion on the question:—

> "An inspector of mines is a Government officer, who has to investigate all sorts of mining matters, and to report impartially to the Home Office the result of his investigations. He must make his inquiries and his reports with a due regard (1) to the interests of the owners of the mine under his observation; (2) to the interests of the responsible manager of the mine, of whose conduct in the control of it he may under certain circumstances have to give a critical account; and (3) to the interests of the miners themselves, for the protection of whose lives and limbs the extended system of inspection has been principally adopted.
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> "It will thus be seen that an efficient inspector must be possessed of sound practical knowledge, and have had a varied experience. His experience should be of that special kind which has made him familiar with the various branches of mining, and which has brought him into contact with the different classes of persons engaged in those branches.
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> "This varied experience cannot be obtained by any merely theoretical college training, nor by any amount of merely practical work in a mine.
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> "However successfully a student may master the several sciences that make up the knowledge of a competent mining engineer, he will be useless as an inspector of mines without having had abundant opportunities of putting his knowledge into practice. And however intelligent and industrious a miner may be in his method of getting coal, and however diligent in studying, after his labor in the mine, the most approved methods of ventilation, and the latest mechanical appliances and arrangements, he must have full opportunities of becoming practically acquainted with all these before he can possibly be capable of judging of their efficiency, or of making any useful report upon them to others."

Such are British ideas of an Inspector of Mines. Those of the Quebec Government may best be gathered from the appointment of Mr. Theophile Viau, of Hull, *a boot and shoe dealer*, as inspector for the counties of Pontiac and Ottawa—an appointment characterized by the *Free Press* as excellent! One hardly knows which to wonder at most, the lamentable ignorance of the government or the blatant idiocy of the newspaper. As for the official, knowledge of his new business is not to be expected or even hoped for from one so utterly devoid of capacity, training and experience. If we are to have a reign of petty tyrants over the province, it is hoped a little more common sense may be exercised in their selection elsewhere, but one, we are afraid, will be a fair sample of all. Bah!

The annual general meeting and dinner of the Gold Miners' Association of Nova Scotia, will come off at Halifax on the afternoon and evening of Tuesday, 10th prox. Science, Literature, Manufactures, Transportation, Trade—and possibly Politics—will all be prominently represented at the banquet, and every endeavor is being exerted to make the gathering a huge success. The *Review* hopes to be a humble participant in the epicurean joys of "boiled Bullion" "baked whin," "mashed fusees," "candied" tappets and the other unique dainties for which the feasts of the Association are so justly noted.

We heartily commend that wise proposition to establish a "Nova Scotia Institute of Mine Officials." A vigorious association having for its objects the discussion of the many questions affecting the best methods of mining the coal—ventilation, hoisting, screening, the safety and comfort of the miners, etc.—cannot fail to be of great practical utility to the operator and the coal trade of the Province. We trust the promoters will meet with that cordial recognition and co-operation to which this proposition is well entitled, and that it will speedily materialize into a strong and vigorous reality.

A bulletin on the anthracite coal regions of Pennsylvania has been prepared by Mr. J. H. Jones, special agent in charge of coal, under the supervision of Dr. David T. Day, of the U. S. Geological Survey. The coal fields are divided into five well-defined geological basins, but are classified for commercial purposes into three general districts, Wyoming, Lehigh and Schuylkill. The total production of anthracite coal in Pennsylvania during the calendar year 1889 was 40,665,152 tons of 2,240 lbs. (equal to 45,544,980 tons of 2,000 lbs.) valued at the mines at $65,718,165, or an average of $\$1.61\frac{6}{10}$ per long ton, including all sizes sent to market. Of this, 35,816,876 long tons were loaded in railroad cars for shipment, 1,329,580 tons were used by employés and sold to local trade at mines, and 3,518,696 tons were consumed as fuel in the mines. In the amount loaded for shipment, is included unsaleable sizes temporarily stocked at convenient points near the mines and tonnage loaded into cars but not passed over railroad scales, as well as waste in rehandling in the various processes of cleaning the smaller sizes. The quantity reported by the transportation companies as actually carried to market, the usual basis for statistics of shipments, was 35,407,710 tons. The item of colliery consumption is somewhat indefinite, the coal being taken either from the current mining or from screenings, and used where needed, often without preparation, and rarely included in the accounts of the operator, being reported in most instances as approximate. For these reasons it has been excluded from the basis of valuation of the product of the mines.

The average number of days worked during the year 1889 by all collieries was 194—the suspension of mining being caused by the inability of the market to absorb a larger product

The total number of persons employed during the year, of all classes, was 125,229, to whom were paid in wages, $39,152,124. The number of regular establishments or breakers equipped for the preparation and shipment of coal was 342, 19 of which were idle during the year. Besides these there were 49 small diggings and washeries, supplying local trade, and there were also 18 new establishments in course of construction. The following items from the tenth census, of the production, etc., in the fiscal year 1879-80, show the progress that has since been made. The gross production, exclusive of culm, was 25,575,875 long tons, valued at $42,172,942; average price of all grades at mines, $1.68. The total shipments were 24,566,822; the number of collieries, 273; number of employés 70,669; and amount of wages paid $22,664,055.

The largest actual shipment during any year in the history of the trade was made in 1888, being 38,145,178 long tons; and the largest during any one month was 4,187,527 tons in December, 1888. Taking the largest monthly shipments ever made up to December, 1889, it is found that a maximum annual shipment of 39,611,813 tons is practicable, and that of 1889, was therefore, 90 per cent. of this. The average monthly tonnage, based upon the foregoing, is 3,300,984 tons; the average annual shipment during ten years ending 1889 was 31,551,301 tons, and during the five years ending at that date, 34,390,868 tons.

The following was the distribution of coal for 1889: Pennsylvania, New York and New Jersey, 22,314,331 long tons or 63.02 per cent.; New England States, 5,407,357 tons, or 15.27 per cent.; Western States, 4,922,076 tons, or 13.90 per cent.; Southern States, 1,613,120 tons, or 4.56 per cent.; Pacific Coast, 20,900 tons, or 0.06 per cent.; Canada, 1,094,736 tons, or 3.09 per cent.; Foreign, 35,190 tons or 0.10 per cent.

The shipments of anthracite coal from the three districts from 1820 to December 1889 were: Schuylkill region, 253,484,053 long tons, or 36.10 per cent.; Lehigh, 128,490,084 tons, or 18.30 per cent.; Wyoming, 320,192,011, or 45.60 per cent.; total since 1820, 702,166,148 long tons.

A directory of the anthracite collieries of Pennsylvania, with the names of operators and the locations, accompanies the bulletin, the whole being a valuable forerunner of the complete census returns.

Principal Mackay has given notice that at the next meeting of the Nova Scotia Institute of Science, in March, he will move the following resolution:—Resolved—That this Institute presses upon the Dominion Government the desirability, from a scientific as well as industrial point of view, of publishing as soon as possible on the scale of one mile to the inch, the long-delayed maps made by the Geological Survey, of the counties of Antigonish and Pictou.

The treatment of magnetic iron ores containing phosphorus, sulphur or titanium, by a magnetic process is, in its practical development, of comparatively recent date, but already numerous improvements on the original form have been suggested, and the machine has attained a high state of efficiency. The application of this principle was, we believe, referred to as long ago as 1869 by Dr. Sterry Hunt, then connected with the Geological Survey of Canada, who remarked that by means of a hand magnet the magnetic oxide of iron was readily separated from titanic in an ore taken from St. Francois on the Chaudière River, Quebec. No use appears to have been made of this discovery—if discovery it may be called—for a number of years, and it was not until about 1880 that a machine was devised to utilize the magnetic properties of these ores. From that time until the present, however, the idea has been kept steadily in view by inventors, and additions have been made and faults remedied until the present separators were evolved. In its earliest form the machine consisted of two cylinders magnetised by induction so as to form positive and negative poles, forming a magnetic field between them, while non-magnetic on the opposite sides. The ore was fed through this field from above, and the cylinders, rotating towards each other at the rate of from 60 to 75 revolutions per minute, attracted all that was magnetic, which adhered to them and was carried around to the point where attraction ceased, when it dropped into chutes, the other components of the ore falling undisturbed below. In most of the later forms of machine a belt has been used, the principle being similar save that the ore being fed on the belts, the magnetic particles are attracted thereto and carried along until beyond the influence of the current, the remainder falling off in another chute. The essential difference in these is the placing of the magnets. One exception must be noted to this rule, however, in the case of the separator invented by Mr. Thomas A. Edison. In this, after the usual preparatory breaking and pulverizing common to all forms, the ore descends from a hopper above the magnet, and falling in a stream in front of it, the magnetic particles are deflected from their course and drop into a separate partition.

A better idea can be gained of the working of concentrators by studying the cut and accompanying description of the Rotary Magnetic Separator published in the columns of our Machinery Department. This is the latest and, we believe, most perfect machine that has yet been produced. It is, as will be observed, a combination of the cylinder and belt types, and unites the best characteristics of each, while in its construction the importance of simplicity has been carefully kept in view. The necessary opposite poles have been attained by an ingenious device, on the one cylinder, the ends being insulated, while the current is diffused over the surface by metal bars running alternately from either side, and insulated a short distance from the opposing pole. The turning of the charged portion of the belt against the current ensures greater purity in the concentrate, and, judging from the appended analyses, this separator has attained results unsurpassed, if not superior to any yet constructed.

An objection has been raised to ores treated in this manner, that the fine pulverization necessary to magnetic separation will interfere with smelting, but experience has shown this to be groundless, pulverized ore having been successfully smelted in Sweden, and, intermixed with large ore, in the United States. The importance of such a method of concentrating to Canadian iron interests is great as by its means enormous areas, hitherto of little commercial value, can be worked. The beds of magnetic sand about the Lower St. Lawrence, for instance, could be successfully treated and rendered available for smelting, while ores of a higher grade could be concentrated to a degree allowing of their profitable smelting in this country or even in the United States, when the situation of the deposit precludes their remunerative treatment on this side, owing to the cost of fuel. Besides, a saving can be effected in lean and clean ores, usually thrown on the waste heap, but which, concentrated, will form an important factor in the economical working of a mine. On these various counts the utilization of the magnetic process seems destined to work a great change in the prospects of iron mining in this country, and its value can hardly yet be appreciated.

It is a very jaundiced eye, indeed, that Mr. J. Lainson Wills casts upon the General Mining Association of the Province of Quebec, which, to judge from his recent letter to the press, is doomed to a speedy dissolution. He is afraid that when the Mining Law issue is set at rest, there will be no longer any common interest to bind the "heterogeneous" components of the Association together, and that they will fall apart. This does not seem very probable to ordinary eyes, and the chances are that Mr. Wills may wait awhile before his fears are fulfilled. But this cause of alarm sinks into common-place as compared with the next doleful foreboding of this second Jeremiah! The Association, he thinks, is confined to too narrow limits by political considerations, while at the same time they are endeavoring to cover too much ground, the interests combined being too many and diverse for its safety and continuance. Whether the association be too narrow or too broad it is equally bound to come to the ground, according to this logic, but to deduce this result on *both* grounds is rather beyond the ordinary intelligence—none but a Wills or a Mickey Free could comprehend it. Still further, the Association cannot "in fairness expect to attach to its roll of honorary members the names of scientists," because a deputation has interviewed Mr. Mercier. Is this wit, or is it an echo from previously unfathomed depths in the great Wills' philosophical intellect? The former we presume—at least "thousands will *laugh* more than did weep at it," to paraphrase the immortal William. On all these counts, this unfortunate body seems to be foredoomed to extinction, but there is yet another and very grave error, the election to the council of so many legal gentlemen and others, whose only interest in mines is that of proprietors. This was the prime cause from which the other disastrous consequences have emanated. It lay in the power of the Association to have avoided these latter misfortunes, but they did not. We venture to predict that had a certain chemist, by the name of J. L——ns——n W—lls, been one of the Council, their present sad position would have been avoided—at all events, we may be sure that it would never have been pointed out in the parcel of meaningless verbosity under consideration.

The Halifax *Critic* is at present in that delightful position known as "sitting on the fence," with regard to the question of reciprocity in coal, inclining one ear to the parties most interested, the colliery owners, while the other is open, with great impartiality, to the voice of the charmer on the New England coast. It reproduced an article recently from the Boston *Transcript*, which proved conclusively, to its own satisfaction, that Nova Scotia coal can be landed on the wharf at Boston for $2 per ton at a profit. It argues thus, regarding a supposed undeveloped coal property in Cape Breton, lying on tide water: The thickness of the average seam is such that a very large quantity is easily accessible. Consequently the cost of production on account of freedom from water, easy methods of ventilation, and the fact that the labor is mainly for mining coal, but little expense being otherwise incurred, is very light, at the outside, fifty cents per ton. Then for transportation, a sea-going tug and two barges of 1,500 tons capacity are assumed, which could make three trips a month for nine months in the year. The expenses for maintaining this line would not be over $200 per day, which for nine months would be $54,000 for transporting 81,000 tons, giving a net freight of about 67½c. per ton. Add to this, as a sinking fund to cover all other expenses, 50c. per ton, which would give $1.77½ as the net cost of Nova Scotia run of mine coal landed on the Boston wharves, and leaving a profit of 22½c. per ton if sold at $2 per ton.

To this Mr. J. R. Lithgow, Secretary of the Glace Bay Mining Company, an authority on the subject, responds as follows :

> In your last issue you publish an article from the Boston *Transcript* which is designed to show that Cape Breton run of mine coal can be shipped and freighted to Boston for $1.77½ per ton, and so leave a profit, at $2 delivered, of 22½ cents. The cost of the coal f. o. b. ship is reckoned at 50 cents and the freight at $1.22½. Now I will admit that with a colliery able to ship 1,000 tons a day and such a sea-going tug as could tow two 1,500 ton coal barges from Cape Breton to Boston in three days, discharge and return in four days, so as to make three trips per month, and keep that up during nine months in the year, as the *Transcript* calculates, the freight should not exceed the *Transcript's* figure, $1.22½ per ton, but it is nonsense putting the cost of coal at 50 cents per ton f. o. b. The mere cutting and filling and the royalty of 7½c. payable to the Province comes to about 50 cents. Then there is the cost of underground hauling to hoisting place; the hoisting, weighing, dumping into waggons, carriage to shipping pier, expense of shipping; ventilating, pumping, usually day and night, to keep pit free from water; the whole requiring a host of drivers for two or three dozen horses—manager, engineers, blacksmiths, sub-managers, firemen, and others. Then, there is the cost of pit-props by the thousand, pit-rails by the mile, hay and oats, &c., for the horses, oils, grease for the waggons, hoisting ropes, picks, shovels, besides the endless supplies for repairs to houses, railway, piers, shutes, &c. The Poor and County Rates and School Taxes are also quite an item. Then there is the expense of head office including pay of directors and clerks. A very moderate estimate of the cost of all these when the output is about 100,000 tons, is 50c. per ton, making with cutting and royalty a dollar per ton, as the cost of Cape Breton run of mine coal f. o. b. Now suppose we value a colliery capable of shipping 100,000 tons a year at $300,000, what percentage thereon would be a fair return for interest, risk, depreciation, and capital yearly parted with in the coals shipped? Say ten per cent. Well, ten per cent. on $300,000 is $30,000, which is equal to 30 cents per ton on 100,000 tons, which added to $1.00 per ton, cost of coal shipped, makes $1.30 as the price a ton of run of mine should net to give a moderate return to the mine proprietors. Few mines in this Province would make simple interest on their cost at that net price. What sheer nonsense then to figure on fifty cents per ton, f. o. b.! As for reciprocity, I agree with what a letter, received this morning from a well informed New York merchant says: "We have no faith whatever in the sincerity of the discussion that has taken place upon this subject here; we believe it to be merely for political purposes, and will result in nothing excepting giving the public some desirable information upon the general subject of domestic and provincial coals."

This effectually disposes of the *Transcript's* arguments, and of the advantages of reciprocity to Nova Scotia collieries at the same time.

Dr. C. Killing, of Amsterdam, is of opinion that the effects of the Quebec Mining Law will be felt far beyond the confines of the province, in its deterring influence on foreign capital. As to the European capitalists represented by himself, the mere fact of a tax being imposed in Quebec will disincline them to invest money in Ontario mineral properties, as they are of course unacquainted with the precise distinctions between the political governance of the provinces, and are naturally disposed to believe that what has been done in one will soon be copied by others.

Phosphate mining seems to have been marked out by short-sighted governments for extinction by the imposition of heavy taxes. In the Province of Quebec, foreign capital has already been driven away, and the industry will soon be at a standstill; in Peru the mines will for the most part be idle for the next ten years, under the impost placed by Chili; and now South Carolina is added to the list by a measure as arbitrary as either. An act has been passed providing for a commission to take charge of the phosphate mining industry. This will consist of the Governor, the Attorney-General, the Controller-General, and two citizens who will be appointed by the executive, who will assume charge of all river phosphate mining in the navigable streams of the State, with power to collect from all mines a royalty not to exceed $2 per ton on all rock mined. The present royalty is $1 per ton, and the companies say that any heavier tax will be ruination. The act gives the commissioners extraordinary powers, authorizing them in case deposits are molested or mined illegally, "in the name and on the behalf of the State of South Carolina to take such measures or proceedings as they may be advised are proper to enjoin and terminate such molestation, interference or obstruction, and place the State, through its agents the said Board of Phosphate Commissioners, or anyone under them authorized, in absolute and peaceable possession and occupation of the same." With such unlimited powers, the commissioners can ruin the industry, if so disposed, and as the three state officers are antagonistic to the existing regulations, it is feared that they may do so. The trouble in Peru and South Carolina would be Quebec's opportunity, were it not for the mining law, but as it is that Province is no better off than either of the others.

Knowing the general interest that is taken in the matter of White's Asbestos Company—which, by the way, is now being voluntarily wound up—we have published elsewhere a full *resume* of the transactions at the last general meeting and also of the proceedings in the company's suit against Mr. Hoare, one of the shareholders, referred to in our last issue. This trial was a revelation of the monstrous frauds not unfrequently practised upon the innocent investors by company promoters, and may perhaps do something towards impressing the necessity for caution upon the minds of the too-confiding British public. Company schemes cannot be too carefully scrutinized and investigated by intending investors, for many of them are nothing but legalized swindling organizations, which not only rob those who put their trust in them but cast discredit upon genuine enterprises.

At the second annual meeting of the Edison General Electric Company, held in New York lately, statistics were presented showing that the profits from October 31, 1889, to October 31 1890, not including those of the Edison Electric Light Company, were $2,098,116, which with amounts carried forward as surplus, $679,401, and interest accounts $4,740, make a total of $2,782,257. Expenses, including dividends paid, $665,314, and amount charged against cost of acquisition of capital stocks of various sub-companies, whose business has been consolidated into this company, together with $206,679 for general expenses, leave a surplus to be carried forward of $1,195,553. The report states that the company has about 6,000 employés on its pay rolls and that the transactions of the past year represented an aggregate of $10,000,000. According to the official record there were in operation on November 1, 1890, within the territory of the United States and the Dominion of Canada, large and small Edison stations representing an aggregate capacity of 1,371,000 lamps.

A teacher at the Ricker Classical Institute took a number of his pupils recently to the electric light station in Houlton, Me., to give them some practical instruction in the science of electric lighting. The professor took his place close to the armature, and to better explain its workings to the class about him, he held a common door-key in his hand. At a certain stage of the exercises the key came in contact with the armature, the magnetic power was too great to break the connection and in a few moments the insulation was torn off and the electric generator burned out. As a result of the experiment, the town will be in darkness until a new armature arrives.

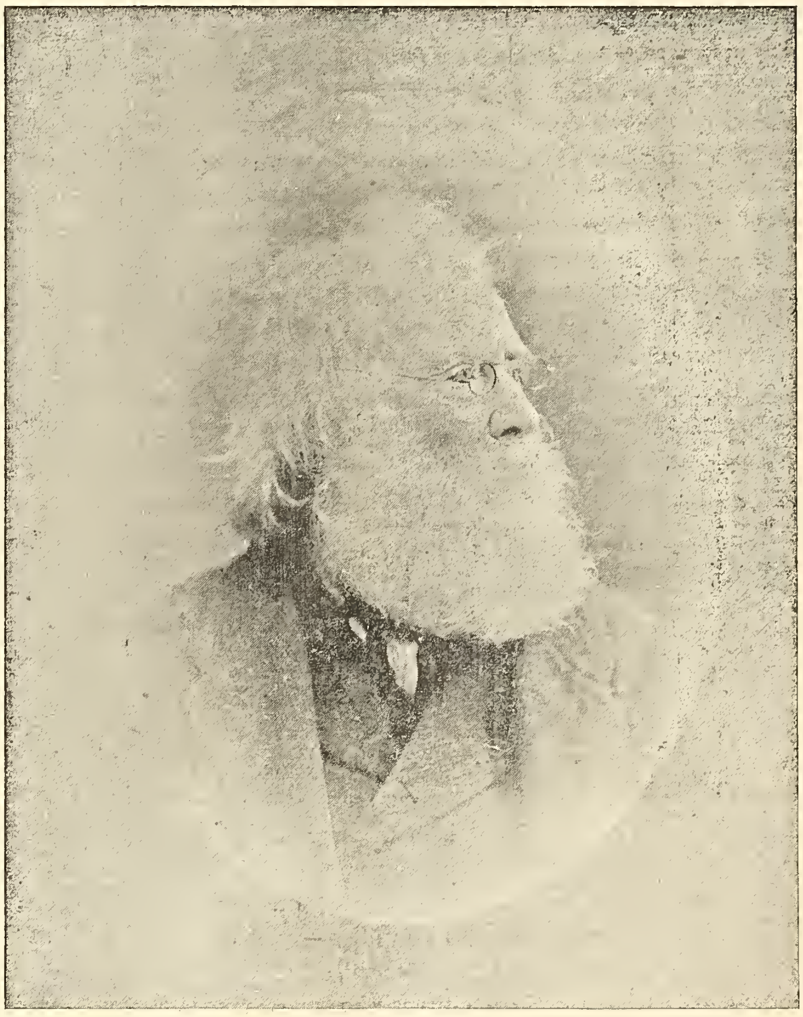
Our Portrait Gallery.

[A series of portraits and biographical sketches of Canadian mining engineers, mine managers, inspectors, geologists, explorers, etc.]

No. 9.

The late Sir William Edmond Logan, F. R. G. S., F.R.S., founder of the Geological Survey of Canada.

No series of biographical sketches of Canadian geologists and mining engineers would be complete did it not include one of Sir William Edmond Logan, who is often deservedly called the father of Canadian geology. Other able workers, it is true, had been in the field before him, but with Logan's appointment as provincial geologist, began the first really systematic investigation of the rocks and minerals of Canada. His selection to carry out this work, was to say the least, fortunate, and being a native of the country, he had from the outset a knowledge of its characteristics and requirements, which it would have taken long for a stranger to acquire. His parents were of that same hardy Scottish stock that produced such men as Hugh Miller and Livingstone, and which, scattered as it is over every quarter of the globe, everywhere exerts a powerful and progressive influence. His education was begun at the excellent school of Mr. Skakel, in Montreal, but he afterwards attended the High School, and then the University of Edinburgh. Though taking a high standing as a student, he did not stay in the University long enough to obtain a degree, but entered in 1817 the counting house of his uncle, Mr. Hart Logan, in London. There he remained until 1831, and there, no doubt, acquired many of those business habits which went with him during the rest of his life.



Yours truly
W. E. Logan

From the busy life of the metropolis we find him transferred to very different surroundings in South Wales, where his uncle had acquired important mining and metallurgical interests. Here he seems to have begun the study of geology, and here he gained that practical knowledge of mining and metallurgy which afterwards proved so useful to him, and which enabled him to appreciate the economic as well as the more purely theoretical aspects of geology. His uncle's mines were situated in the Glamorganshire coal-field, and though for a time he was chiefly concerned with the getting of coal, he soon became deeply interested in the geological structure of the region. A theodolite and other instruments were purchased, and every spare moment that he could obtain was devoted to the production of a geological map of the district. Though he had received no training in surveying or mapping, his work was executed with wonderful skill, and soon attracted the attention of scientific men; as a result of which we find that in 1837 he was elected a Fellow of the Geological Society of London. During his study of the Glamorganshire coal field, he became interested in the question of the origin of coal, and began those investigations which eventually proved that ordinary coal seams are not mere accumulations of drift wood, but the result of the growth and subsequent decay of plants *in situ*. His views on the subject were communicated to the Geological Society in the form of an interesting paper, which was published in their Transactions.

After the death of his uncle, Logan resigned his position in Wales, and we find that in 1840 he came on a visit to Canada. Here he spent a winter, and made a study of the phenomena connected with the annual freezing over of the St. Lawrence, the results of which were embodied in an admirable paper read before the Geological Society in 1842, and also published in their Transactions. Before his return to England in 1841, he visited Nova Scotia, and it was there that he discovered, at Horton Bluff, the tracks of a batrachian, the first evidence of the existence of such animals at so early a period of the earth's history.

The facts concerning the origin of the Geological Survey of Canada, and the appointment of Logan as its first Director, cannot be detailed here. It may be said, however, that the establishment of such a Survey had been discussed for years, but nothing really practical was accomplished until 1841, when the matter was taken up by the government and the sum of £1,500 Sterling for the purpose included in the estimates. In the following spring the position of "Provincial Geologist" was offered to Logan, owing to his having been most highly recommended by all the leading English geologists, and, fortunately for Canada, was accepted. A visit was shortly afterwards made to this side to make preliminary arrangements, but the regular work of the newly established Survey was not begun until 1843. Logan was then forty-five years of age, but he entered upon his new duties with all the enthusiasm of youth, an enthusiasm that never abated during the twenty-six years of his Directorship.

This is not the place to follow him minutely through all this period of ever increasing activity, but no one can do so without being astonished at the results accomplished. Had he been suffered to devote himself more exclusively to geological investigations, science would, no doubt, have reaped a still larger harvest at his hands; but he was perpetually harassed by the routine duties of his position, and by the struggle to obtain the necessary grants for carrying on the Survey. During the earlier years of his Directorship, in addition to preparing his annual report, he even kept the accounts, entering every item of expenditure, so that he could at any time show exactly how every penny of the public money placed at his disposal had been spent. At that time too he made with his own hands four manuscript copies of the Annual Report of Progress—often amonnting to more than one hundred printed pages—one copy for the Government, one for the House of Assembly, one for the Legislative Council, and one for the printer. In a letter addressed to the Minister of Finance in 1864, he says: "The professional responsibilities and difficulties of conducting a geological survey, over so large an area as Canada presents, are quite sufficient without being complicated with those of finance. But the minds of those charged with the investigation can never be free from pecuniary anxieties while the support given to the Survey lasts only from year to year, and has to be struggled for every session of Parliament." Fortunately he was possessed of private means, and when Parliament was dissolved without granting supplies, rather than have the work of the Survey brought to a standstill, he voted an advance of the necessary money from his own pocket.

The great Expositions of 1851, 1855 and 1862, absorbed a great deal of the time that he coveted for geological work, but his exertions on these occasions were of great benefit to Canada in attracting attention to her mineral and other resources, and were also rewarded with many well-deserved personal honors. After the Paris Exposition of 1855, the Imperial Commission presented him with the grand gold medal of honor, and the French Emperor made him a Chevalier of the Legion of Honor. He was also knighted by Queen Victoria, and received from the Geological Society of London the Wollaston Palladium medal in recognition of his distinguished labors in geology.

The need of a building wherein to arrange and display the minerals brought together from different parts of the country, was early felt by Logan, and in 1844, after his first summer's exploration in Gaspé, he wrote to De la Beche, the director of the British Survey, as follows: "From the Devonian and Silurian rocks I collected no less than seventy boxes of specimens, which it took Murray no less than two months to ticket and stow away in boxes for future examination, when the government shall give me room to place them in order. I have hired a house on speculation, and am ordering proper cases to hold some of them, in the confident expectation that the expenditure will he sanctioned by the Legislature. But, perhaps, I may be reckoning without my host, and may be left in the lurch after all."

The house referred to was No. 40 Great St. James Street, Montreal, and here was made the beginning of the geological collection which has since attained such great dimensions, and which demands a better building for its exhibition than the hotel in which it is at present "lodged."

We cannot here discuss at length the geological work of Logan, but his name will ever be intimately associated with that great Laurentian system of rocks, whose intricacies he so skilfully unfolded, and whose mineral riches he brought to light. The importance of this work was long ago recognized by scientific men, and in dedicating the fourth edition of "Siluria" to Logan, Sir Roderick Murchison wrote: "I now dedicate this volume to the geologist who has not only applied my classification to the vast regions of British North America, but has taught us, by his recent important researches, that the Laurentian rocks constitute the foundation stones of all Palæozoic deposits in the crust of the globe, wherever their foundations are known."

It was for Logan, too, to prove the existence of a second great series of crystalline rocks (the Huronian), resting unconformably upon the Laurentian, and also to identify and trace out the distribution of the various formations of Canada younger than the Huronian. The facts ascertained were from time to time embodied in a series of clearly written reports, illustrated by maps, whose excellence is too well known to require comment here. Attention was constantly directed to the economic minerals of the country and their development, but Logan always rightly held that the director of a geological survey should not be regarded as a public consulting mining engineer paid by government. On one occasion when urged to give an opinion on a copper-bearing location, after reiterating without avail that he was a geologist and not a mining engineer, he was pressed for an answer to the question whether there was not an enormous quantity of copper within the area described. He disposed of both the intending seller and contemplating purchaser by the reply: "There is an enormous quantity!—an enormous quantity!—and it is my opinion that it will cost just a little more than it's worth to get it out." In this answer we have an example not only of the caution by which he was characterized, but also of the quiet humor which at times was manifested only in the twinkle of the eye, but ever and anon found vent in words. Those who have heard him sing the "Laird o' Cockpen" will not soon forget it, nor will those who have sat by the fireside with him forget the tales of backwoods experiences which he gave with such exquisite touches of humor and pathos.

In 1869 Sir William resigned his position as Director of the Survey, owing to increasing years and a desire to be freed from official responsibilities. This, however, did not preclude his carrying on geological work, which he continued to do for some time.

The announcement of his retirement was received by the public with deep regret, and "never was the press of any country more unanimous in its expressions of approval at the career of a public servant."

In August, 1874, being in rather poor health, he crossed to the mother country, intending to spend the winter with his friends in Wales, and to return to Canada in the spring; but the change of climate and scene had not the effect hoped for, and the spring of 1875 found him in a condition of great weakness, which continued until the 22d of June, when, at the age of seventy-seven, he was called to his rest.

His name and work are our heritage, and the Survey established by him and his able associates still goes on, the fittest monument to his memory. Could he return to us and see the Survey of to-day, with its increased facilities for work, its broadened sphere of action and its admirably arranged collections, we are sure he would be gratified, and would feel that the lines laid down by him, and which have in the main been followed by the present Director, were well and wisely laid.

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The amount invested in electric lighting enterprises in London is said to be about $15,000,000. The largest sum—$6,250,000—is invested in the London Supply Company, whose factory is at Depford, but the whole of the amount has not been called up. The next largest is the Metropolitan Company, whose capital is $2,500,000. This company, though financially smaller, has more business than the preceding—it got to work more expeditiously. There are in all nine companies. They are not competitors, in the true sense of the word, for each company has a fairly well defined area assigned to it, after permission of the local authorities, by act of parliament. In the city there are rather less than 150,000 lights supplied by the companies. Many establishments, such as factories, large warehouses and hotels, provide their lighting by isolated plants.

The Springhill Calamity.

The announcement of the distressful accident at the East Slope of the Cumberland Railway and Coal Company's Colliery, at Springhill, will be read throughout the length and breadth of the country with feelings of profoundest sorrow. It is truly a calamity too terrible in its effects yet to be thoroughly realized; it is unquestionably the worst casualty of its kind in the annals of Canadian mining. Latest advices compute the mortality at least at 120 persons, of whom 54 were married men, 40 single, and 25 were boys, leaving behind some 54 widows, 161 orphans and five widowed mothers, entirely bereft of every means of support. To these, in their sore bereavement, the heartfelt sympathy of the entire mining community goes out to-day, and a ready and generous support will, we know, be made to the following stirring appeal for immediate pecuniary assistance:—

To the Public :

"A mining disaster, attended with fatal results unparalleled in the history of Canadian miners, has fallen upon the town and people of Springhill, Nova Scotia. The loss of life is probably as great as the combined appalling loss at the Drummond and Foord pit explosions. About 117 lives are lost, fifty-one widows have been left behind, and 151 children made fatherless. The widows and the fatherless will require abundant assistance, and that promptly, from a public, shocked and horrified by this terrible calamity. Seventy-thousand dollars will be required to meet the demands and to alleviate the suffering of the bereaved and distressed during the most pressing period of their direful misfortune. The residents of Springhill, in meeting assembled, have appointed a committee consisting of the Mayor, Town Council, and all the resident clergy to solicit and acknowledge subscriptions to the Springhill Relief Fund, and they confidently and earnestly ask for an immediate response from persons of all denominations, societies, guilds, trades and nationalities."

(Signed), WILLIAM HALL, Mayor,
A. MCLEOD, Secretary.

We will gladly acknowledge in these columns any contributions that our readers may send to our care. While many conjectures have been made as to the cause of the disaster, nothing definite will be known until the investigation, now going on under direction of the Mines Department, has been completed. The mine has been generally regarded as safe and free from gas, there being excellent ventilation and the best of management. In another place our readers will find details of the accident as wired from the scene of the disaster by our special correspondent. A fuller reference will be made in our next issue to the cause of the accident and the result of the investigation. In the meantime we commend the widows and orphans of this grief stricken community to the generous consideration of the mining community of the whole country. He gives best who gives quickly.

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Mr. C. C. Hoyer-Millar, of Messrs. Couper, Millar & Co., London, a firm well known to the Canadian phosphate trade, has published, in handy form, his impressions of a recent visit to Florida, and the new field for investment in its phosphates. Mr. Millar says that in view of the rapidly increasing demand for phosphates of all grades, it is exceedingly unlikely that the supplies from that much "boomed" country will affect production in other quarters. He points out that though Florida can, and will eventually, produce large quantities of "high grade," yet the proportion of this quality to the total tonnage extracted will be much smaller than is generally estimated.

CORRESPONDENCE.

"Quebec for the French."

SIR: Such is the policy of the Mercier Government. It was elected at a time when the fanaticism of the French Canadians had been aroused by incendiary demagogues because a half-breed French criminal had expiated his crime on the gallows. With the war cry of "race and revenge" on his lips, Mr. Mercier went to the polls and was elected by an overwhelming majority—commissioned by the French Canadian people to use every constitutional means to expel the English speaking population from the Province of Quebec. He has been true to his mission, as the statute books of Quebec, laden with recent legislation aimed against the English speaking minority, only too clearly testify. What the end of this policy will be it is difficult to foresee; but if it could prove successful, it would be a victory purchased at a price which the half bankrupt province can ill afford. With the English speaking minority would, unquestionably, go the prosperity of Quebec. They are the leaven which stirs the inert mass of the population. The majority, impoverished by the rapacity of their rulers, spiritual and temporal, befogged with superstition and sodden with ignorance carefully perpetuated by their leaders, have neither capital, ambition nor enterprise. Their system of education, if it can be called a system, produces but two classes—serfs and schemers. Outside of the English speaking minority there is no intelligent public opinion in any part of the Province; serfs cannot entertain, even though they had the courage to express, an independent opinion. They do as their leaders bid them, and when, as was the case at the time of Mr. Mercier's election to power, the leaders temporal and the leaders spiritual struck a bargain and agreed upon a division of spoils, there could be no doubt of the result. A show of opposition was made—enough to give a flavor of British constitutional government to the oligarchy at Quebec. The boodling of the demagogues and the exactions of the church are matters of as great notoriety as the growing debt of the province. The *habitants*, ground between the upper millstone of the tithing system and the nether millstone of the plundering politicians at Quebec, have nothing left but their peas and their piety. Expediency, as well as policy, points to the thrifty English speaking minority as the only remaining source of revenue. Thus the Quebec Mining Act, with other legislation of kindred character, has been brought into existence. In your last issue was given a summary of some of the worst features of the new Mining Act. If enforced with the rigor which the fanaticism and cupidity of the authorities at Quebec would lead us to look for, this legislation means the persecution of the mine owners and the confiscation of their properties. It will unquestionably arrest the development of the mining industry; it will exclude foreign capital; it will cripple those enterprises which the pluck and perseverance of the English speaking minority have established; it will impoverish many, and, indirectly, paralyze trade in large sections of the province. Mines which are not yet paying will be at once closed. Others, which yield an uncertain, precarious profit, will be run on a reduced scale. Mining lands of all descriptions will fall in value, and in the end the boomerang launched at the minority will strike with fatal effect the very people whose malignant spirit prompted the attack.

What is to be done in this crisis? To meet an organized attack, organization is necessary. Let the mining interest throughout the province unite for self defence. If they can protect their rights by an appeal to the Federal authorities or to the courts, that will be the easiest way to avert the calamity. If redress cannot be had by such means, then meet fire with fire; employ none, deal with none who are in sympathy with the brigands at Quebec. If the laborer who voted for Mercier's candidate finds that he has thereby deprived himself of the means of earning a livelihood, he will soon learn the significance and responsibility of the franchise. If supplies of all kinds are procured from none but opponents of the Mercier Government, or from abroad, the *habitant* will quickly learn that it is suicidal policy to countenance a government which deprives him of his best—often his only market. The lumber trade has also suffered from the persecuting policy of the Nationalist Government. If the miners and lumbermen would combine in self defence, they would soon put an end to the "race and revenge" policy, and show the majority that the descendants of the men who conquered their forefathers, have the strength and the pluck to guard the fruits of Wolfe's victory.

A CANADIAN.

Montreal, 24th Feb., 1891.

Quebec Tax on Mining.

SIR: In the Montreal *Gazette* report of 31s utlt., of the proceedings of the Mining Association, at its meeting on 30th ult., in Montreal, I note with much interest, the suggestion by its chairman, Hon. Judge Irvine, for a petition to the Dominion Government to veto the obnoxious Act just passed by the Legislature of Quebec, imposing a so-called "royalty" on baser minerals, the output of private property.

In November last (17th to 22nd) and on 29th December, I wrote a series of letters on the subject, in the Montreal *Gazette*, giving briefly the legal argument against such imposition as unconstitutional; and further as being in direct conflict with the public policy and specific legislation of the Dominion Government on the subject; and on that ground, suggesting veto by it. On this particular point, I remarked that the Montreal *Gazette* in an editorial, though commending my letters in their general tenor, expressed a doubt as to the power of the Dominion Government to veto in such matters. It was, I concede, quite excusable to do so, for there is no more difficult class of questions in law and politics than that of *inter* Dominion and Provincial jurisdiction in such and such like matters, on which to arrive at a conclusion. However, on this particular question as to the right of a Provincial Government to impose, or rather, to assume a "royalty" in such matter, the law, to the contrary, is clear and incontestable. Such—as reported—is the opinion of Judge Irvine, and I am glad to see it so emphatically expressed by him on the occasion. It supports mine, as advanced in the letters above referred to, given spontaneously at the juncture as the result of professional study and formulated legal opinions on several incidental cases submitted to me in the course of many years of practice in the essentially mining regions of Ottawa North.

Evidently, the Quebec Government are either nescient or heedless of the law on the subject, and are bent on pursuing their own political ends irrespective of public or private right and interest. If there be no check, summary and efficient, in our political constitution for such violation of the "peace, order and good government of Canada," in its integrity and its severalty, as contemplated in the British North America Act, 1867, the sooner we know it, and have the defect remedied, the better. For such contingencies, something more Alexandrian than litigation should be applicable. Extortion, though under color of legislation, is, nevertheless, such wrong as to call for speediest remedy. In such a case as this—a tyranny and spoliation utterly unwarranted and fraught with evil and mischief beyond measure to the whole body politic, not only of the Province of Quebec, but of the Dominion, of which it is a potential constituent—the paramount duty of the executive of the dominant government is to check such evil as quickly and effectively as possible. In this direction, the suggestion of Judge Irvine for an immediate petition to the Dominion Government for its veto, is one to commend itself. Should it fail, there will always remain to the wronged ones, the spoliated, cheated and robbed, the Fabian remedy of the courts. That men courageously, and, in a sense, nobly risking their money in the hazard of mining to the profit *in any case*, of the labor classes of Canada, should be thus treated under the name and shadow of British Government, is something to shock the sense of social life and rouse the indignation of righteous governance.

In our great body politic, hurt or wrong to a class, or a part, however small, is injury to the whole. The truism is full of historical evidence. Against "ship-money" England rose! So, ever, in like cases.

Ottawa, 2nd February, 1891. M.M.

Mineral Resources of Ontario.

SIR: I have been away from home for some time and since my return have read some very interesting articles in your publication in review of the Report of the Royal Commission on the Mineral Resources of Ontario, of which commission I was a member.

Especially in connection with your remarks on iron smelting and comments on trade aspect, I would like to draw your attention to the fact that it is stated in the first part of the report that the different sections were contributed by the various members of the Commission, who are alone individually responsible for the sections written by them. The report which precedes Section I is the sole joint production of the Commission.

In that you will find it stated: "Mining enterprises should as far as possible, consistently with a fair consideration of the claims of all other interests of our country, be secured the advantages of the *home markets*." And in connection with the smelting of iron, "The industry is of first-class importance, and every proper means should be taken to secure its establishment in Ontario."

And again, "It is unquestionably in a country's interest not only to smelt its own ores, but to refine and manufacture the metals, providing always that the various operations can be carried on economically and without taxing other interests indefinitely for their maintenance."

WM. HAMILTON MERRITT.

Toronto, 24th Jan., 1891.

Ore-Dressing Machinery.

SIR: Referring to Prof. Clarkson's interesting London lecture, the Professor, while not aware that there was such a pulverizer as the Centrifugal, combined "roller" and "attrition" "Narod" Mill, evidently anticipated its coming. The "Narod" requires on an average 15 horse power, produces with a twelve screen a product 90% of which will pass through a 60 screen, and nearly all the remainder through a 40 screen; capacity on phosphate rock 5 to 7 tons per hour; very hard quartz, mineral paints reduced very fine, marble, plaster, Portland clinker, talc, &c., &c., all 2 to 3 tons per hour. This increased capacity and almost uniform fineness of output are secured by the aid of the two spiral fans on each of the 3 shafts which take up the material after the preliminary grinding by the rolls, and keep it in self-frictional agitation (attrition), until reduced fine enough to pass through the screen that may then be in use. The pulverized material falls between the screen and the jacket through apertures in the bottom into a hopper, and is thence conveyed by elevator buckets. The inventor, Mr. V. L. Rice, the president of our company, is also the inventor of the roller process for the manufacture of flour, the advent of which has abolished buhr-stones all over the world. Perfect granulation of the "wheat berry" is there preserved, and perfect granulation is also preserved in the "Narod" Ore Mill. Grit is carefully guarded against, and is prevented from reaching the journals by leather caps. Oiling of all but the main upper journal is required only once a week, and of the main journal only once in two or three days. The weight of mill and foundation timbers is only 5,500 pounds. Rolls and ring are made of the hardest known manufactured substance, viz., chilled carbonized iron. The maximum speed required is 140 revolutions per minute.

AMERICAN ORE MACHINERY CO.,
E. R. WILLIAMS, Sec'y.

NEW YORK, February 12th, 1891.

Steam Boiler Tests as a Means of Determining the Calorific value of Fuels.

SIR: There was a slight inaccuracy in the examples of method of finding horse power in the article under the above title, published in your issue of December last. It should read:—

"Total heat of 1 lb. of feed water at 40° = 8 B. T. U. $1175.710 - 8 \times 2000 \div 1110.343 = 210.33 \div 30 = 70.$"

Perhaps it would have been better in regular algebraic form, but I thought it might be clearer, to steam users who are not engineers, in the way given.

D. W. ROBB.

AMHERST, N.S., February 12th.

Examination of Mines.

BY PROF. H. S. MUNROE.

In a previous article[*] it was shown that questions as to the value of a mining property, and as to the methods of working, cannot be answered definitely until the character and probable extent of the deposit are well determined. This in turn requires that the property be developed by surface and underground workings. To determine whether the property is worth development, and to devise a systematic and economical plan of exploration demand careful preliminary study. The method of making the necessary examination and surveys for this preliminary study was described at length in the above-mentioned paper.

Passing over for the present the methods of prospecting and of developing a mining property, the present paper will treat of the examination of mines or of developed mineral properties.

The objects of such examination are the valuation of the property and the determination of the proper method of working the deposit, including, among other things, the proper scale of mining operations.

VALUATION OF MINES.

The value of a mine is determined by its capacity for earning profits or dividends.

If, for example, we assume the proper rate of interest, all things considered, at 10 per cent., then a mine earning one hundred thousand dollars a year should be worth a million dollars.

The problem, however, is not as simple as it would appear at first sight, and the determination of the proper rate of interest demands careful consideration. In the first place the business of mining is peculiar, in that it is a temporary business. Any given mineral deposit or mining property will be exhausted sooner or later; and the more actively it is worked the sooner will the business of mining come to an end.[†]

The value of a mine should, therefore, be computed on the basis of the present value of a limited annuity, and not according to the rules of simple interest.

Again, the business of mining is risky. All mineral deposits are more or less uncertain. Even beds of coal, perhaps the most regular of all, are liable to contain unworkable areas, and often pinch out and disappear entirely.

In the case of metalliferous deposits, irregularity and uncertainty are the rule rather than the exception. An engineer's estimate of the yield of a deposit, or the life of a mine, must take into account this element of uncertainty, which is greater for some classes of deposits than for others.

Mining is subject as well to the ordinary risks of similar business operations. The market value of the product varies with supply and demand, is affected by the cost of transportation, by tariff legislation, and by other outside influences. The cost of labor and of the necessary supplies is also subject to change, and the profits of mining may be seriously reduced thereby. The mine workings and surface plant are liable to be destroyed by fire and by floods, and by other accidents peculiar to mining, such as explosions of fire-damp and the caving-in of the overlying strata.

The fact that mining is a temporary business makes it necessary to provide for the repayment of the capital invested in the property, and that required for the development and working of the mine. In estimating the profits a certain sum must be added to the working expenses to provide a sinking fund for this purpose. This fund should be large enough to extinguish the capital within a less term of years than that estimated as the probable lifetime of the mine.

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[*] Examination of Mineral Property, School of Mines Quarterly, vol. xi., No. 3, p. 193.

[†] The rapid exhaustion of mines is a characteristic feature of modern mining, especially in this country. In the older mining regions of Europe are mines centuries old, and still productive. In this country mines equally large and deep have been excavated in a single generation. The introduction of machine drills and high explosives have revolutionized the art of mining.

In estimating the value of a mine on the basis of an annuity for a term of years, the interest assumed in computing the present value of the annuity should be large enough to cover the mining risk. For example, let us suppose the case of a mine with a total capital of one million dollars, which is to be repaid in ten years, money being worth 5 per cent. A sinking fund of about eighty thousand dollars per year will be required. To pay interest on the capital, with no allowance for mining risk, the mine must earn fifty thousand dollars additional, or one hundred and thirty thousand dollars per year will be required. Thus the stock must earn 13 per cent. dividends per year in order to pay interest on the capital invested, and to repay that capital in ten years. In other words, the stock must earn over two and one-half times the commercial rate of interest to be worth par.

The same result is reached by the use of a table of annuities. Here we find that the present value of a ten-year annuity, money being worth five per cent., is 7.72 times the yearly income. With a present value of one million, the income must be one hundred and thirty thousand dollars, as before. In order to take into account the mining risk in the above case, the yearly earnings under the above conditions should be not less than 20 per cent., and under some circumstances 30 or 40 per cent. per annum, or from four to eight times the commercial rate of interest.

In Nevada. when the Comstock mines were declaring large dividends, the stocks yielded about 40 per cent. income per year on their selling price in the stock market. The commercial rate of interest in Nevada at that time was 10 per cent. The stock in this case earned four times the usual rate of interest, and was sold for two and a-half times the yearly profits.

In the Lake Superior region the stocks of the dividend-paying mines earn from 8 to 25 per cent. per year on their average market value.

The Calumet and Hecla mine occupies an exceptional position in this respect. The mine earns from two to three millions in dividends per year, and is estimated to have at least thirty years' further life at the present enormous rate of production. The average selling price shows that the stock-holders are content with 8 to 10 per cent. interest. The allowance for mining risk in this case, assuming money to be worth five per cent., is very small.

Prof. J. C. Smock,* in estimating the value of the iron mines of New Jersey, assumes the average life of the mines at fifteen years, and the rate of interest at four per cent., and multiplies the yearly profits by seven to obtain the value of the mine. This corresponds to a yearly profit of 14 per cent., or three and a-half times the rate of interest assumed.

Examples might be multiplied, but the above will serve to show that each case must be judged for itself. To estimate the value of any mine we must know the amount of capital required, the probable life of the mine and the yearly profits, and make due allowance for the mining risk.

When the deposit is completely exposed, or is of such a nature that its continuance may be safely predicted, the value of the property can be computed with great accuracy.

When, however, the deposit is unreliable, and its future cannot be predicted with any degree of certainty, an accurate estimate of value is impossible.

In such case it is, perhaps, best to make two estimates of value. One of these should be based on the mineral† "in sight," which is proved to exist, and which can be accurately measured and valued. This estimate will give the minimum cash value of the mine as far as developed.

The other estimate should be based on reasonable probabilities as to the future, and will represent a value more or less speculative. Conservative engineers usually confine themselves to the valuation of the mineral "in sight," and take no account of probabilities.

Nevertheless, the speculative or probable future value of the mine will have weight with the intending purchaser or investor. He, or some one for him, will make some kind of an estimate of this probable value. Such estimates are likely to be exaggerated, and may work great harm. An estimate of the speculative value of the property, made by an expert who is able to weigh the probabilities intelligently, will enable the purchaser to decide the amount of risk he is justified in taking. Careful estimates of this kind will tend to prevent extravagant valuations from obtaining foothold, and will tend to discourage the over-capitalization of mining enterprises which has worked so much injury to the mining industry of the country.‡

WORK OF EXAMINATION.

The examinations to obtain the necessary data for the valuation of the mine will be, so far as the surface is concerned, on the same lines as the preliminary survey detailed in the last article. If there has been no such preliminary examination of the property, a topographical and geological survey should be made, following the scheme of work as previously outlined. This survey and examination can be complete and thorough, as the work of exploration and development have made the deposit accessible at all points.

In the examination of the property the following outline of work should be followed :—

1. Study carefully the deposit and its associated rocks, and minerals at numerous points, and determine its geological character. Determine, if possible, the method of its formation, especially when this is likely to have important bearing on the questions of regularity and continuance of the deposit. Specimens should be obtained for lithological study, if this is likely to throw additional light on the formation of the deposit or on the occurrence of the useful mineral.

2. Study and map the zones of rich and barren ground, the "pay chutes," "bonanzas," "ore-course," "chimneys," "horses," "faults," "squeezes," etc., and endeavor to determine the laws governing the distribution of such zones and their average size and frequency of occurrence, as well as the relative areas of good and bad ground.

3. Make careful measurements, at as many points as possible, of the thickness of the deposit and of its different sub-divisions or benches. Obtain the data to compute amount of mineral "in sight."

4. Make a survey of the underground workings, and construct sections to exhibit the data obtained and as a basis for the study of the deposit.

5. Obtain from different parts of the mine a sufficient number of samples for assay to give an accurate determination of the average richness or quality of the mineral. The samples should be so taken as to show variations in richness or quality in the different parts of the mine. If any mineral has been mined, and is accessible in cars, bins or stock piles, this should be sampled. If any of the mineral has been sold, or treated in dressing or smelting works, secure data as to the results obtained.

6. Study the deposit and the inclosing rocks and overlying strata from the standpoint of the practical miner, and note conditions likely to have influence on the methods and cost of developing and working the mine, on drilling, blasting, timbering, drainage, ventilation, etc.

7. Determine the proper scale of operations. and estimate the amount of capital required.

8. Obtain data for estimating the cost of mining and mechanical preparation of mineral, probable cost of labor and supplies, sources and cost of fuel, timber, water, etc.

9. Determine proper metallurgical treatment, and estimate cost of same.

10. Ascertain cost of transportation of supplies and product, and whether liable to change.

11. Study the market for the product ; note the effect of increased production or competition on selling price.

12. Inquire as to the history of similar enterprises in the vicinity and commonly received opinions as to the richness and quality of mineral that can or cannot be worked.

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*Trans. Am. Inst. Mining Engineers, vol. x, pp. 288-293.

† The word "mineral" in this article will be used to cover productive vein rock and ore, as mined, as well as coal, iron ore, rock-salt, etc.

‡See also Practical Mining by J. G. Murphy, E. M. D. Van Nostrand, 1890.

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The Copper Deposits of the Province of Quebec.*

Dr. R. W. Ells, Ottawa.

While we have seen that the presence of iron ores in workable quantities was known in Eastern Canada more than two hundred years ago, and have been utilized for nearly a century and a half in the manufacture of metallic iron, the first reference to deposits of copper in the Province of Quebec is apparently contained in the reports of the Geological Survey, 1847-48, where, on pages 26-27, the presence of copper pyrites is noted in connection with the limestone of Acton, Upton and Wickham, and further north in Inverness. Reference was, however, made in 1830 by Gen. Baddeley, R.E., to the copper ores of Western Ontario, but at this date it does not appear that anything was known in relation to those of Quebec. As regards the deposits observed in Quebec, and referred to by Sir William Logan in the report just mentioned, the quantity was generally regarded at that time as unimportant; but several localities were recommended for trial. Among these was a quartz vein on lot four, range two, of Inverness, having a thickness of about two feet, with a course a little north by east, which, however, upon testing, although the quality of the ore was excellent, did not appear to contain sufficient to render its further exploration profitable. A second area recommended for trial at the same time was the seventeenth lot, seventh range of Ascot, about one mile from Sherbrooke, on the road to Lennoxville. The thickness of the quartz vein carrying copper pyrites was from ten to twelve inches, cutting chloritic and talcose slates, and it carried, in addition to the copper ore, small quantities of gold and silver. The third locality recommended was in the fifty-first lot of the twenty-first range of Upton; the breadth of the lode, which is in a whitish-gray massive limestone, being from twelve to eighteen inches, consisting of white quartz and calcspar, carrying pyrites also in small quantity.

Assays of the ores from these three localities were made by Dr. Hunt. The percentage of metallic copper in the washed pyrites from Ascot was 30.34, or eighteen per cent. of the vein; from Inverness, 34.93, or seven per cent. of the unwashed ore, and from the Upton lode, from an average sample, 3.84 per cent.

In the report of 1849-50, reference was made to traces of copper in the rocks of the Chaudière, in the seigniory of St. Joseph, where, in rear of the church at that place, spots of vitreous copper were found disseminated through quartz veins in red and green slate, and about one mile from the Chaudière river on the road to Frampton.

Similar ore in quartz veins, in the red slates, was also at the same time noted as occurring in St. Mary's seigniory; but neither of these localities appeared to possess any special value. The deposit at Upton was opened up and found to consist of a series of bunches, following a bend in the stratification; but the opinion was expressed that their irregularity was such as to seriously interfere with their being successfully worked for copper.

The copper deposits of the eastern townships appear to have been entirely neglected for some years after this, but some examinations made about this time on the north side of the St. Lawrence, in the augmentation of Lanoraie and Dautraye, on the left bank of the River L'Assomption, showed the presence of a vein nine inches thick of calc and pearl spar, cutting gneiss, which carried copper and iron pyrites. On either side of the main vein, other veins were reported of an inch or more in thickness, also carrying copper pyrites, and the whole was comprised in a breadth of about nine feet. In this a shaft was sunk for sixteen feet, the vein, which had the aspect of a regular lode, appearing uniform throughout, though the quantity of copper it contained did not appear to be remarkably promising.

A more detailed description of the Upton deposit appeared in the report for 1858. It is there stated to occur in a mass of greyish-white, sometimes reddish-grey limestone, compact, sub-crystalline and yellowish weathering, reticulated by small veins of copper pyrites, as well as by others of quartz and various ores of iron, all of which were regarded as of segregation origin. This ore-bearing limestone was overlaid by a bed of breccia, or conglomerate, which also carried pyrites and was supposed to be underlaid by red-grey limestone, which, towards the bottom, became interstratified with red slates. No copper was found in the underlying limestone.

The general dip of the measures was to the south-east at angles of 10° to 27°. The bands of limestone carrying ore extend through the northern part of Acton into Wickham, where, also, on the twenty-sixth lot of the last range of that township, they also carry similar ores. A second band to the south-east is seen at Acton on lot thirty-two of the third range, which extends approximately parallel to that just mentioned, and also at Wickham, and this was regarded as the equivalent of the Upton bands of rock coming to the surface on the south side of the synclinal. The description of the rocks of this copper belt is considered of some importance, as illustrating a peculiar series, in which has occurred, more particularly at Acton, and presently to be described, one of the most productive copper mines ever worked in Quebec ; a band entirely distinct in character from those which contain the copper deposits now so extensively worked in the townships. In order that the relations of the several ore belts may be better understood, we may here proceed to describe, before taking up the history of the several copper mines which nearly thirty years ago were so prominently before the mining public, the views of structure of the several areas of cupriferous rocks, as stated in the Geology of Canada, 1863 and 1866, more especially since the new views of the structure and of the age of these rocks, as stated in the more recent reports, have modified the opinions there expressed to a very considerable extent. The metamorphic rocks of eastern Quebec were, for many years, regarded as the altered equivalents of the fossiliferous and comparatively unaltered sediments of the St. Lawrence basin ; and these were divided at first into two and subsequently by sub-division into three portions, viz.: The Levis, Lauzon and Sillery formations.

These were supposed to be arranged in a series of long and sometimes narrow folds, with many overturn dips, of which it was remarked that "the latter circumstance renders it difficult to determine which of these folds are synclinal and which anticlinal, inasmuch as the outcrop in both cases presents a similar arrangement." These metamorphic rocks, for the portion north of the Vermont boundary, considered to be specially cupriferous, were held to occur in three approximately parallel bands or areas. Thus the first area, or the most westerly, extended from Farnham, near Missisquoi Bay, to the seigniory of Lauzon, on the St. Lawrence. Where it is traversed by the St. Francis, it was supposed to be nearly, or quite, separated into two parts by the appearance of what was then regarded as the underlying series of slates. In this supposed synclinal are found the deposits of Upton, Acton, Wickham, Roxton and Durham, while in the northeastern extension are those of Wendover, Somerset, Nelson and St. Flavien. The second area, which was supposed to be divided into two parts by the ridge of the Sutton Mountain, extended from St. Armand to the seigniory of Ste. Mary, on the Chaudière. In this were the copper deposits of the townships of Sutton, Stukely, Melbourne, Cleveland, Shipton, and further to the north-east those of Halifax, Leeds, Inverness and Ste. Mary.

The western portion of this supposed synclinal occupied the Sutton valley; the eastern, the Potton and Bolton area along the valley of the Missisquoi River. The third area extends from the Owl's Head on Memphremagog Lake to the Township of Ham, and included the Stoke Mountains, while further to the northeast it was traced across the Chaudière into Buckland. It was supposed to be separated from the last by what were regarded for the most part as newer rocks, much of which were supposed to be of Upper Silurian age, although now known to belong, in great part, to much older horizons. In this area were included the deposits of Ascot, Ham and Garthby.

The rocks of the first or more westerly area, extending from Farnham northeasterly, were regarded as belonging to the Lauzon and Sillery divisions of the Quebec group. They include slates, black, red, green and grey, with sandstones, diorites and dolomitic limestones, which are seen at many points.

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*Mineral Resources of the Province of Quebec, 1890.

The outcrops at Upton and Acton appear to be very similar in character, and probably represent portions of the same series, brought to the surface by synclinal structure. Of the second main synclinal, as then considered, viz., that in which the Sutton Mountain was supposed to occur, the rocks vary somewhat on either side of the mountain ridge; those on the west being, for the most part, schistose and crystalline, either talcose, micaceous or chloritic, while on the east side there is a large development of serpentines, diorites, slates and hard quartzite. The rocks which were found in the third area, or that of Ascot, were also largely schistose, resembling rather those of the western side of the Sutton Mountain than of the eastern. It will be seen, therefore, that there is a manifest difference in the character of rocks in the three areas, and, by a careful examination of the copper ores obtained from each of those, a corresponding difference in their character will also be observed; the ore of the Ascot belt being unlike that from the Potton area, while this in turn is of a different character from that of Acton or Inverness and Leeds. The studies made of these several groups of strata during the past ten or fifteen years have led to an entire change of opinion regarding their relative age and structure from that expressed in the Geology of Canada, 1863. Instead of now regarding these different copper-bearing belts as synclinals in the Sillery or other divisions of the Quebec group, and all of Lower Silurian age, it is now very clearly established that, while the rocks of the first area are, in large part, of the age and character of what have been described as the Sillery formation, and which is now held to form the lowest member of the fossiliferous Quebec group, as developed along the south side of the St. Lawrence river, those of the second and third areas, or of Sutton and Ascot, belong, for the most part at least, to the pre-Cambrian horizon; while the slates and serpentinous or dioritic portions may, probably with more propriety, be classed in the lower portion of the Cambrian system, the slate-rocks of which flank the pre-Cambrian schists on either side, and that the greater part at least of these crystalline schists really occur as anticlinal axes instead of as synclinals of altered Lower or Middle Silurian rocks. As just stated, the character of the ores in the different copper-bearing belts,—for it is scarcely necessary to maintain the use of the term synclinal in view of the change of opinion expressed—varies greatly when contrasted. Thus, from the more westerly belt the ores are largely yellow sulphurets, though occasionally variegated sulphurets are found, mostly in a dolomitic limestone. In the township of Roxton the principal deposit was on lot twenty-three, range three, where the ore, according to the late Mr. Charles Robb, M.E., who had great experience in the mines of this section of Quebec, appeared to be disseminated through a band of this rock for a breadth of fifty feet, but was more particularly concentrated into a breadth of about one foot near a band of diorite. From the west half of this lot, belonging to Lord Aylmer, there had been obtained in January, 1864, fifty-six tons of three and a half per cent. ore, sixteen tons of five per cent. and two tons of twelve per cent.; and from the eastern half, eight tons of eight per cent. and fourteen of three and a half per cent. were taken. In the adjoining township of Ely, though indications of ore are found at a number of points, the principal deposit was on lots nine and ten of the second range, owned by the Ely Copper Mining Co., where the ores were the yellow and variegated sulphurets in a crystalline limestone. In Upton, mining was carried on at four places, viz.: 1st, on lot forty-nine of range twenty, called the Bissonnette Mine, where there was a yellow sulphuret in a thickness of three feet and a half of dolomite, yielding from 10 to 15 cwts. of 10 per cent. ore per fathom. 2nd, at the Prince of Wales Mine, on lot fifty-one of the same range (the ore being scattered through about twenty feet of the same band as the last), from which about forty tons of twelve and a half per cent. were obtained from open cuttings. 3rd, on lot forty-nine, range twenty-one, the ore and rock being similar to the last, and owned by Col. McDougall, by whom, from open cuttings also, about twelve tons of twenty per cent. ore and eight tons of twelve per cent. were obtained; and 4th, the Upton Mine, on lots fifty and fifty-one of the same range, where two shafts were sunk to a depth of forty-two and twenty-five feet respectively, which yielded a considerable quantity of ore, the amount, however, not being stated.

In the township of Acton several mines were located and worked to some extent about this time, but of all these, that known as the Acton Mine, situated on the thirty-second lot of range three, and about half a mile south of Acton station, on the Grand Trunk railway, was the most important.

The discovery of this mine is said to have been made by Mr. H. P. Merrill, but the date of this discovery is not mentioned. In a paper by Mr. Robert Williams, for many years connected with copper mining in Eastern Quebec, read before the Literary and Historical Society of Quebec, 1865, we learn that in the autumn of 1858, operations were commenced by Mr. Sleeper; and "that although the discovery of copper ore of very rich quality was known some years previously, so incredulous appeared the human mind on the subject that the property was purchased by Mr. Davis, of Montreal, from the owner, Mr. Cushing, of Actonvale, for a very insignificant sum and a royalty, but that gentleman had so little faith in his purchase that he at once leased it to Mr. Sleeper on tribute, at two-thirds of all the ore that he could obtain from it for a period of three years."

It was largely in consequence, apparently, of the great results obtained by Mr. Sleeper at this mine, that the great boom in copper and copper explorations took place in the townships, which resulted in the finding of the ore in greater or less quantity at hundreds of places throughout the areas already outlined, and of which a full list of localities will be found in the report of the Geological Survey for 1866, by Mr. James Richardson. The peculiar character of the deposit at this place, and the great importance which for some years attached to this mine, renders it worthy of a somewhat detailed description. When first found "the surface presented an accumulation of blocks of copper ore, evidently in place, and covering an area of about sixteen paces in length by ten in width. These masses consisted of variegated sulphuret of copper, intermingled with limestone and a siliceous matter, without anything like veinstone, and evidently constituted a bed, subordinate to the limestone, whose strike was about north-east, and with a dip to north-west at an angle of about 40°. In continuation of this bed, for about seventy paces in either direction, the limestone was observed to hold little patches and seams of variegated ore and yellow pyrites, with stains of the blue and green carbonates of copper. The limestones in the immediate vicinity presented several veins of quartz crossing the strike, but containing only traces of copper."*

The mine was worked by Mr. Sleeper, to September, 1861, when it reverted to the proprietors, Messrs. Davis & Duncan, of Montreal, by whom it was sold, in October, 1862, to the Southeastern Mining Company of Canada. The enormous masses of rich ore-bearing rock gradually became exhausted, though no attempt at any very deep exploratory works appears to have been undertaken. According to Mr. Richardson's notes, the mine produced, during the period in which it was worked, 16,300 tons of 12 per cent. ore, sent to market, besides a great amount of lower grade left at the surface.†

The ore at this mine, from a number of sections furnished by Mr. Thos. Macfarlane, who was in charge of operations there for some time, and who published an exhaustive paper on the subject in the Can. Nat., 1863, is apparently for the most part confined to a bed of dolomitic limestone interstratified with dark grey shales, a considerable thickness of which lies between the copper limestone and a great mass of another limestone band, which forms a prominent ridge to the south of the workings. Between the copper limestone and the shale beneath, intrusions occur, often of considerable size, of a greenish, fine-grained diorite which are also at times found above the limestone band. The strata, both above and below the limestone band, also contains small strings of copper pyrites, but the workable deposits are for the most part confined to the calcareous portion. The cupriferous rocks appear to be bent in an anticlinal fold, and are to some extent affected by faults; these being probably due to the diorite intrusions.

The bed of limestones, which appears to have carried the bulk of the ore, in places appeared as a solid mass, at others as a brecciated rock or conglomerate; those which consisted of the pyritous, the variegated and the vitreous, being disseminated through the brecciated bed constituting, to some extent, with silica, the paste of the mass. The ore deposit at Upton presents a somewhat similar set of conditions, with the important difference that, while at Acton the prevailing ores were vitreous and variegated, at Upton the ore was mostly a pyritous sulphuret. If the two localities of Upton and Acton should be the outcrop of the same beds on the two sides of a synclinal, it is very possible that other large deposits of similar ores may occur other than already worked. To test this point at Acton would, however, require considerable expense of shafting. Several bore-holes have been put down, but the results obtained have not been made available. From the fact that red slates of the Sillery formation cross the Grand Trunk railway a short distance east of this mine, and appear also, near the village of Acton as well as in the lower beds of Upton, it is probable that this unusual development of copper is in rocks of this age, and that its presence is due to the intrusion of dioritic matter at this point, since at other localities in this formation, as at Nelson, St. Apollinaire, etc., though the amount of copper is not so large as at Acton, the presence of diorite masses at these places, in somewhat similar rocks, has apparently produced similar effects, though on a much more limited scale. Among other localities in this township where exploratory work was carried on about this time, were lot thirty-one, range four, called the Vale mine, the results from which were of little value, and the White Horse mine on lot twenty-nine of range six, and on lot thirty-one, range three, the ores being very similar to those of the Acton mine, and, as at that place, occurring in dolomite. It is probable, that the diorites were absent from these localities, no mention being made of them at either place. In Wendover, in the diorites which cross the St. Francis from the town of Drummondville, several shafts from 30 to 40 feet in depth were sunk between 1860 and 1863 by the Drummondville Mining Company of Canada, but without finding copper in any quantity, though just before the suspension of the company a large vein was reported to have been struck. Since the failure of this company no further attempt has been made to ascertain its value.

In Wickham but two mines were located. The first and most important was styled the Wickham mine, on lot fourteen, range ten, the ores being yellow and variegated sulphurets in dolomite.

Here a shaft was sunk to a depth of thirty feet and a few tons of ore removed. The Toomey Mine, on the third lot of the eleventh range, was similar in rock and character of ore, but the work done was merely exploratory and confined entirely to the surface.

In the township of Durham, adjoining Acton, the same character of ores is found. Two mines were here started of which that on the twenty-first lot of the seventh range, styled the Durham Mine, was apparently the more important. Shafts were here sunk on three veins, varying from three to twelve inches in thickness, the deepest of which was eighty-four feet, ending in black slate. The ore obtained amounted to ten tons of five per cent., 110 tons of three per cent., and 300 tons of one per cent., consisting of yellow sulphuret in a calcspar vein cutting dolomite. On lot nine, range six, a shaft was also sunk to a depth of sixty-four feet in similar ore, but no returns are given; and on the southwest half of lot nine, range four, a shaft was sunk to a depth of forty feet, showing good specimens of the variegated and yellow sulphurets, while a second shaft of sixty feet was sunk on the northeast quarter of the same lot, in green and black slates, for which no returns are available.

In Somerset. near the northern portion of this area, small quantities of the yellow sulphurets have been observed in beds of limestone conglomerates near diorites; and in Nelson, on lot eight of range eleven, the yellow and variegated ores are disseminated through limestone, also near diorites, from which about ten tons were extracted by a company formed in Boston, the width of the ore-hearing bed being about thirteen feet. At various points along this line also, indications of ores for the most part similar to those already described, but presumably in even smaller quantity, were observed. In the county of Lotbinière, near St. Apollinaire, indications of the yellow sulphuret are found in amygdaloidal diorite; and in this vicinity the St. Flavien mines were worked about thirty years ago. Since that time no attempt at exploration in all this area appears to have been made.

Throughout the rocks of the western division the workable deposits of copper also appear in all cases to have been associated with masses of intrusive diorite, which have penetrated the red and green slates and limestones of the Sillery formation, now regarded as forming the upper portion of the Cambrian system. The want of success which has attended many of these workings is due largely to decline in the price of the copper, and also to a lack of concentration of the ore in the cupriferous beds, since the quality of much of that obtained is excellent, and in some cases, peculiarly rich, as seen in the Actonvale deposits.

Of the mines found in the second belt, beginning at St. Armand, it may be remarked that the ores here observed differ somewhat both in character and mode of occurrence, and, as already pointed out, in the nature of the containing rock. In this area, at the time of the great copper excitement, several localities were indicated in which traces of copper, both the sulphurets and the carbonates, the latter in green chloritic and epidotic rock, were found, but none were at that time shown to be of much importance. In 1882, however, a vein of yellow and variegated ore was opened on the south side of the Pinnacle Mountain, St. Armand, in greenish micaceous and chloritic schist, which was worked for some time, and at first promised well. Crushing and concentrating works were erected, and a considerable quantity of the ore extracted and prepared for market, but the works were shortly after abandoned, and no returns from this location are to hand. In the township of Sutton, adjoining, copper mining was carried on at a number of points; indications of the presence of the ore being frequent. These ores were mostly the yellow sulphuret, but green carbonate of copper, with deposits of the variegated and vitreous ores, are frequently observed.

Among the most important of these in this township, and which have been opened up to some extent, may be mentioned the following:—

Sweet's mine, on the west half of lot eight, range ten, where variegated and vitreous sulphurets occur in a bed of nacreous schists from one to four feet and a half wide, which, for the whole breadth, yielded four and a half per cent. of copper. A band of dolomite occurs in the vicinity, but the ore is confined principally to the schists; differing in this respect from those of the first belt, of which the Acton mine may be taken as the type. This mine was one of the first opened in this portion of Quebec—samples being displayed at the International Exhibition in London, 1862. The schists in which it and the mine on the Pinnacle are located belong to a distinctly lower geological horizon than that of the belt just described from Farnham north.

A considerable quantity of ore was raised from the Sweet mine, but probably the limited size of lode interfered with its successful development.

The works of the North Sutton Mining Co., were located on the north half of the eleventh lot in the tenth range, on a bed from eight inches to two feet thick, in talcose slate, near black plumbaginous slate. Three shafts were sunk, one of which was twelve feet deep, and about two tons of five per cent. ore obtained. Explorations were also carried on by this company on a seven foot vein in nacreous slates, on the west half of lot twelve, range eleven, carrying yellow sulphuret with iron pyrites, but no returns are at hand from this exploration.

Two shafts of a depth of fourteen and nineteen feet respectively, were sunk.

(To be continued).

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* Report Geol. Survey 1858, pp. 57, 58.

† See Geol. Can. Supplement, 1866.

The Nickel and Copper Deposits of Sudbury District, Canada.*

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The town of Sudbury, a creation of the Canadian Pacific railway, is situated in the backwoods of Ontario, thirty-six miles north of the mouth of French river on Lake Huron. Parts of the surrounding country are tolerably level, but in a general way this region may be said to be hilly. Some sections are very broken and rugged, while in others rocky ridges alternate with swamps or alluvial intervals. Occasional tracts of land are fit for cultivation, but, as a rule, where the surface does not consist of rock or swamp it is much encumbered with boulders. At one time the district supported large quantities of white-pine timber, but forest fires at different periods have destroyed the greater part of it and inferior kinds of wood are now growing up in its place. Rock maple, red oak, black birch and other hard woods form considerable groves in some sections. The general elevation of this tract is probably between 800 and 1,000 feet above the sea.

The construction of the Canadian Pacific railway in 1882 led to the discovery of nickel and copper, besides various other metals, in this part of the province, and now the Sudbury district promises to become of great importance as a mining region. It may be remarked, in passing, that Sudbury is not the name of a political division but is merely a convenient designation, in connection with mining, for the territory lying partly in the district of Nipissing and partly in that of Algoma.

THE GEOLOGY OF THE DISTRICT.

As a preliminary to the proper understanding of any account of the nickel and copper deposits of the Sudbury district, some remarks on the geology of the region will be necessary. The district is situated in the course of the best known and perhaps the longest Huronian belt in Canada. Beginning in the west, the general northerly boundary of this great belt commences at the promontory of Namainse† on the east side of Lake Superior and runs approximately parallel to the shore of that lake, the St. Mary's river and the north shore of Lake Huron, as far as Spanish river, leaving a border of Huronian rocks of varying width between the water and the Laurentian nucleus to the north. Near Spanish river the dividing line between the two systems turns inland and runs northeasterly nearly to Lake Wahnapitæ, whence it trends northward and northwestward till it gains a point lying northeast of Michipicoten on Lake Superior, thus almost surrounding a large elliptical area of Laurentian rocks.

The boundary between the Huronian trough and the Laurentian system along its southeastern side leaves the shore of Lake Huron at Shibaonaning ("Killarney") and runs in a tolerably direct line to the foot of Lake Temiscaming at the great bend of Montreal river, and thence it continues in a somewhat zigzaging course nearly to the southern end of Lake Mistassini, 335 miles due north of Montreal, or a total distance of 600 miles from the commencement of the belt on Lake Superior in a general course, or 700 miles, following the axis of the trough. Lake Wahnapitæ lies at the upper extremity of the contracted portion of the Huronian belt after it has turned northeastward from Lake Huron, but beyond it these rocks spread out widely to the northward.

Within the general limits of the Huronian region just sketched, we find a good many inliers of gneiss and red quartz-syenite, some of which correspond with Laurentian types of these rocks, and it is uncertain whether they are protrusions of the older rocks from beneath, or whether some of them may not be portions of the Huronian itself which have undergone further metamorphism. Among these inliers the following may be mentioned; A large one between Goulais bay and St. Mary's river; a long narrow one occupying the shore of Lake Huron between Thessalon and Mississagui rivers; a small one in the township of McGiverin; three on Lake Wahnapitæ; one at Paul's lake on Sturgeon river; one to the east and one to the north of Lake Temagami; one on Lake Temiscaming; two on the main Montreal river, and several on its upper branches.

In the middle of that portion of the belt in which Sudbury is situated there is, besides the inliers mentioned, a long tongue of gneiss and red quartz-syenite, which begins beyond the northeast corner of the township of Garson and runs southwestward into Denison, a distance of thirty miles, and is joined to the main body of these rocks to the westward by dark grey, rather fine-grained imperfect quartz-syenite and gneiss, which may be seen all around Wia-shai-gaming (or "Fairbank") lake.

The gneiss and the quartz-syenite of these isolated areas in the Sudbury district replace or pass into each other in such a way that it would be very difficult to represent them separately on a geological map. A singular feature about them is that both kinds are in many places broken up into separate masses like large and small boulders, the interspaces being filled by a breccia with a dioritic paste, of which the fragments consist of the country rock or of a finer or preëxisting breccia of the same composition. This takes place over such considerable tracts as to suggest the idea that these rocks may be underlain at no great depth by diorite which was in a soft condition after the gneiss and syenite had been consolidated.

The narrowing of the Huronian belt, which happens in the Sudbury district, is due to the extension into it, from the westward, of a large area consisting mainly of red quartz-syenite. This rock is of a medium texture and has a very uniform character over several thousand square miles, except that in some parts it gives place to red syenite without quartz and in others to ordinary gneiss. The relation of this great syenite area to the vast Laurentian country to the northwest has not been carefully determined, but it appears to merge into the prevailing gneiss in that direction and is certainly connected directly with that terrane.

At some places within the syenitic area, as for example about two miles west of Cartier, a massive fine-grained rock, like some varieties of graywacke, may be seen passing into thoroughly crystalline quartz-syenite. The fine-grained imperfect gneiss and quartz-syenite around Fairbank lake may represent one of the earlier stages of the coarser and more crystalline varieties of these rocks. An ordinary looking variety of gneiss is being formed out of a slaty kind of graywacke in the township of Hyman.

In the district under consideration the main line of the Canadian Pacific railway crosses, almost at right angles, the narrowest part of the Huronian belt proper, which has here a width of only about twenty-four miles. The strike is therefore northeast and southwest, and in this pinched portion of the trough the rocks on the opposite sides dip at high angles toward the centre. Sudbury Junction is situated southeast of the centre of the trough, and from it the Sault Ste. Marie branch of the railway runs upon the general strike of the Huronian rocks throughout almost its entire length. At thirty-three miles northwest of Sudbury Junction, or near Geneva lake, the main line enters upon an outlying basin of stratified Huronian rocks measuring eight miles in width on the railway by seventeen in length from northeast to southwest, and having a long point running westward into the township of Craig. This, for convenience, may be called the Geneva lake outlier. At the southern extremity of Onaping lake, a few miles to the north of this outlier, there is a smaller one, measuring only three miles in width by four in length.

The various members of the Huronian system in the Sudbury district are of much interest in connection with questions relating to metamorphism and the origin of crystalline rocks, and also as illustrations of the general character of the system in this part of Canada. They consist principally of graywackes and quartzites, various forms of diorites, quartz-diorites and hornblende schists, mica schists, diabases, argillaceous sandstones, black and drab clay slates, together with volcanic breccias, in addition to the gneiss and quartz-syenite already referred to.

The rocks which occur in greatest quantity in the stratified Huronian belt between lakes Huron and Wahnapitæ, and which constitute the lowest members of the series, are quartzose graywackes and quartzites, with occasionally a little felsite. Thick bands of quartzites, mostly very light in color and standing at high angles, form the conspicuous range of La Cloche mountains overlooking Lake Huron and the long narrow points projecting into that lake between Spanish river and Killarney. The fact that this great local development of quartzites happens to occur at the most accessible part of our principal Huronian belt has given rise to the erroneous notion that the Huronian rocks of Canada in general consist mostly of these rocks. The quartzites of the region about La Cloche appear to belong to three or four belts which double around in a synclinal form, and are thus repeated within comparatively narrow limits. Quartzite constitutes the principal rock all round Lake Panache and along the lower parts of Vermillion and Spanish rivers, but further to the northeastward, or in the contracted part of the belt of the Sudbury district, the corresponding rocks, with a greatly diminished volume, are much mixed with felspathic and argillaceous matter, constituting massive graywackes; while still further on, or in the country east of Lake Wahnapitæ, they have passed almost entirely into pure argillites, which are very extensively developed. To the north of Lake Wahnapitæ the quartzites reappear in great force. On the opposite or north-western side of the Sudbury trough this series is represented by a thick band of gray quartzite, which appears to be always characterized by scattered pebbles of white quartz, but it is insignificant in volume compared with the quartzites and graywackes along the southeastern side of the trough.

In the graywacke and quartzite area of the region under consideration the crystalline diorites occur as numerous intruded masses, varying from half a mile to ten miles in length. They are of various forms, but their greatest diameters are approximately parallel with the strike. The rock is generally of a dark or sea-green color and moderately finely crystalline. Three or four of these masses occur around Lake Panache and nine or ten to the northeast, between this lake and the Canadian Pacific railway line, and seven more beyond that part of the railway between Sudbury and Wahnapitæ river. About a dozen small diorite areas have been found in the quartzite and argillite region around Lake Wahnapitæ. Besides these massive diorites, bands of obscurely stratified varieties of the same rocks, of quartz-diorite and of dioritic and hornblendic schists are sometimes associated with the quartzites and graywackes in the townships of McKim and Denison, in the Geneva lake outlier, along Spanish river and around Lake Wahnapitæ. A beautiful and very coarsely crystalline hornblende rock occurs near the Dominion, the Stobie, and the McConnell mines and in a few other localities.

Bands of compact brown-weathering dolomite, generally whitish and dove-colored, occur, locally, in the graywacke and quartzite series. They are found in considerable volume on different parts of Lake Panache, and they occur also near Lake Huron in the township of Rutherford, on La Cloche lake, on Wahnapitæ river, on Geneva lake, and near Cartier station. Similar dolomite is occasionally found as patches in the finer-grained syenite or altered graywacke.

Two long and remarkable intrusions of diorite of a grey color and having a coarser texture than those already described are found cutting the gneiss and quartz-syenite areas of this region. They are each about a mile wide in the middle. Both run northeast and southwest, or parallel to the general strike of the stratified portions of the Huronian rocks nearest to them, and diminish to narrow points at the extremities. The first of these commences at Whitson lake, in the township of Blezard, and runs south-westward into Denison, a distance of twenty-four miles, while the second has been traced from the northeastern part of Lavack for about eighteen miles southwestward. Most of the heavier deposits of nickeliferous ore, so far discovered, are associated with these two diorite belts, and they will be again referred to in this connection. A smaller dioritic intrusion, apparently of the same class as those two and running parallel with them, is found in the northeastern part of the township of Morgan.

The next member of the series, in ascending order, is the most remarkable of all. It consists of a thick belt of nearly black volcanic breccia, which has been traced from Vermillion lake northeastward in the valley of Vermillion river to beyond the latitude of Wahnapitæ lake. It is a compact silicious rock, with conchoidal fracture, and consists of angular fragments, mostly small, closely crowded together and flecked with irregular angular white spots. These Dr. G. H. Williams finds to consist of fragments of pumice, which, while retaining their structure, are completely replaced by silica. This band appears to be several thousand feet thick and, as it has resisted denudation well, forms an elevated, rough and broken country along its whole extent.

The highest rocks of the series in this district, or those which occupy the centre of the trough, are made up of evenly bedded drab and grey argillaceous sandstones or graywackes, interstratified with shaly or slaty belts, and overlain at the summit by black slates. As these rocks dip at comparatively low angles, they occupy a greater geographical width than the other members in proportion to their thickness, which, however, must be very considerable.

Along the lower part of Spanish river, above and below the great bend, the Huronian belt has a wider spread than near Sudbury Junction, and here we find a considerable development of rocks associated with the quartzites which are not met with to the northeastward in the district under consideration. Among these are, soft bluish-grey satiny sericitic schist, sometimes ligniform, accompanied by nearly black hornblendic schist: coarse and fine-grained glossy green and greenish-grey schist; silver-grey fine-grained mica-schist, studded with crystals of saturolite; hard green schist; dark-grey clay-slate; fine-grained greenish-gray silicious felsite; and slaty graywacke, passing into gneiss.

The stratified Huronian rocks and also the gneiss and quartz-syenite of Sudbury district are traversed by dikes of gray, coarsely crystalline diabase, which are often large and can be traced for considerable distances. Their commonest course is about west-northwest. They all have the same physical characters and appear to be of identical composition. The sound, fresh rock is extremely tough, but the exposed surfaces disintegrate easily under the weather into brown crumbling débris, especially along the joint-planes and at their angles. The outer portions of the masses thus separated scale off concentrically, so that they become rounded and boulder like. These dikes, as we shall show further on, apparently play an important part in the economic geology of the district.

THE ORES AND THEIR ASSOCIATIONS.

Referring now to the nickel and copper ores for which this district is becoming famous, it may be remarked, in the first place, that there is much uniformity both as to the characters of the ores themselves and the conditions under which they occur. Yet these deposits are not confined to the undoubted Huronian rocks, but are equally abundant within the gneiss and quartz-syenite areas. They may be said to be connected with a certain geographical area rather than with a single geological horizon. In other words, it would seem as if, within certain limits, the ores might have had their origin beneath all the rocks found at the surface. The ore consists in all cases of a mixture of chalcopyrite and nickeliferous pyrrhotite. The area over which this ore has been found up to the present time extends from the Wallace mine, on Lake Huron, in the vicinity of La Cloche, northeastward to the north side of Lake Wahnapitæ, a distance of about seventy miles, and from the southeastern boundary of the Huronian belt, in the Sudbury district, northwestward to the limits of the Geneva lake outlier, a distance of about fifty miles.

It is rather singular, first, that pyrrhotite should exist so commonly within this region as compared with any other in the country, and, secondly, that no matter in what kind of rock we find it to occur, it should generally be nickeliferous to an economic extent. Although, as a rule, pyrrhotite, wherever found, contains traces of nickel, it has only been detected in commercial quantities in a few places in other parts of the world.* The investigations of the writer in the Sudbury district have shown that the combined nickel and copper ore is found on or near certain lines of contact between diorite, on the one hand, and gneiss or quartz-syenite most frequently on the other, but only at certain points on these lines. As no circumstance is without a cause, we may look for some reason which determines the concentration of the ore at one place more than another, and the writer believes he has found the reason in this case to consist in the intersection of the ore-bearing belts near these occurrences either by one of the diabase dikes above described or else from the pinching in or perhaps from a transverse disturbance of the belt.

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* Bulletin of the Geological Society of America, vol. 2, pp. 125-140

† Meaning, little sturgeon; often improperly spelled Mamainse.

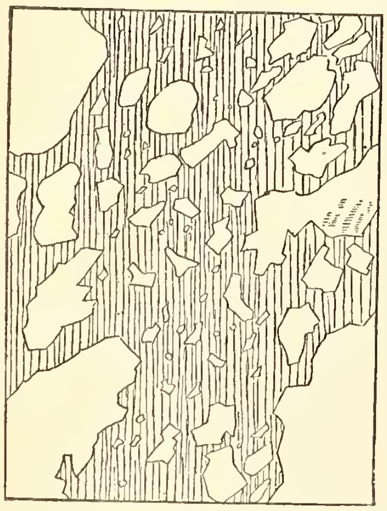
* Assays have recently been made of samples of pyrrhotite from near Schreiber and Jackfish bay, Lake Superior, and from the counties of Peterboro', Hastings, and Lanark, in Ontario, none of which yielded more than traces of nickel.

The ore seems to have been derived in all cases from the diorite, but for some reason the proximity of the gneiss or quartz-syenite appears to be also favorable for the production of the large deposits. If the diorite flowed out originally upon the nearly horizontal surface of the other rock, the constituents of the ore which it contained may have sought the lower portion of the mass ; or if it were injected between the preëxisting rocks, these materials may have been impelled to the sides.

In some cases the belts of diorite are much broken up and disturbed longitudinally, and along these horizons they are mixed with large and small fragments of other rocks showing lines of volcanic movement during their formation. Examples of coarsely brecciated diorite of this kind may be seen near the Dominion mine, the Stobie mine, and thence southwestward to beyond the Canadian Pacific railway, at the Copper Cliff, the Crean or McConnell and the Vermillion mines, in Denison, at Ross' location north of Morgan township, in the northeastern part of Lavack and near the western end of Bannerman lake. This condition of the diorite seems favorable for the production of the ore, probably on account of the physical disturbances which it indicates. The lines of northeast and southwest disturbances, along which successive occurrences of the ore are found, cannot always be traced continuously on the ground, but as the evidences of such disturbances make their appearance from place to place upon these lines, and as geological breaks are apt to be very persistent, we may infer that they are continuous.

The first of the two long, narrow intrusions of gray crystalline diorite which have been referred to, in its course from Whitson lake to the township of Denison, cuts off a narrow slice all along the southeastern border of the tongue of gneiss and quartz-syenite which lies in the middle of that part of the Huronian belt. The ore deposits of the Waddell, Dominion, Russell, Little Stobie, Murray, McConnell (in Snider), Lockerby and McIntyre properties, of lot 10, range I, of Snider, of the Crean or McConnell mine, and of the "mineral range" of Denison appear to be all situated along the southeastern side of this diorite intrusion, or in its course, when it becomes narrow ; while those of the Stobie and Frood mines and the other occurrences for two miles southwest of the former, of the Copper Cliff and others in the vicinity, of the Evans, of lot 12, range III, of Graham, and of the Vermillion mine lie along the southeastern side of the separated slice of the gneiss and quartz-syenite range just referred to, and mostly within the diorite belt which skirts it on that side.

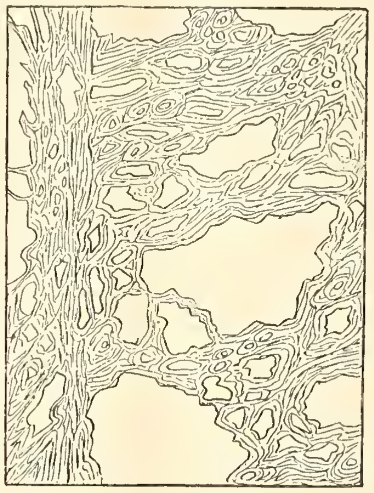
The north wall of the Copper Cliff mine is formed of felsite, quartzite, and a coarse red mixture of felspar and quartz, besides diorite like that of the south wall ; but the ore itself is invariably associated, here as elsewhere, with the diorite. The Evans mine is situated further from the contact of the gneiss than any of the others. The top of the ridge on which it occurs consists mostly of graywacke, but the ore is accompanied by diorite which in parts passes into a kind of soapstone or serpentine. A break in the continuity of the gneiss and quartz-syenite ridge runs northwestward across it from the Copper Cliff to the McConnell mine, and all along this break there are evidences of the existence of the ore, accompanied by crystalline and schistose diorites and a brecciated condition of the gneiss and quartz-syenite. The Evans mine appears to be connected with a continuation of this break.



A number of more or less promising occurrences of the mixed ore have been found in the two southern ranges of Denison, in Louise, Lorne, Navin, Baldwin, Drury and Hyman and further north in Neelon and McKim. All these are associated with diorite. In some instances they have been found to be connected with lines of fracture and this may prove to be so in all cases. The discoveries of the ore which have been made to the west of Lake Wahnapitæ are also in diorite in the vicinity of quartz-syenite.

MODE OF OCCURRENCE OF THE ORES.

The various occurrences of the mixed nickeliferous pyrrhotite and chalcopyrite, as far as they have yet been opened up, all resemble each other so closely that a description of one will apply to all. They are associated primarily with the diorite masses which conform more or less nearly with the general strike of the other rocks of the country. The older lines of fracture or disturbance are also approximately parallel with the strike, but their planes may incline at different angles from the local dip. The ore-bodies take the form of stock-works following the direction of these ancient faults. The bodies are made up of a mixture of the country rock and the sulphides in the shape of a confused mass of coarse and fine fragments of the former, while the ore itself constitutes the matrix or filling between them. The fragments are of every size, from mere grains to that of nuts and small and large boulders and even great horses. Sometimes the smaller pieces are packed so closely together as to admit of the addition of little ore, while at other times the interspaces are wide and allow the introduction of large quantities of solid ore. The chalcopyrite generally occurs in the midst of the pyrrhotite as distinct masses of irregular form (sometimes quite large), or as streaks, patches and spots ; but occasionally the two sulphides are more intimately mingled. In a part where the pyrrhotite prevails an included fragment of the country rock may be coated with chalcopyrite, or the latter may lie as a bunch between the rocky fragments, and *vice versa* as to the other sulphide. There is no uniformity in their mode of occurrence with regard to one another, and they appear to have been introduced among the fragments of broken country rock simultaneously and under the same conditions. The dioritic wall rocks on either side and also the included boulders and even the smaller fragments are often thickly impregnated with disseminated grains, spots and patches of all sizes, both of pyrrhotite and chalcopyrite. These spots of ore have usually rounded outlines in cross-section and approach spherical and ovate forms. The two sulphides may occur side by side in the same isolated kernels or amygdules ; but just as frequently the latter consist of one or the other alone, although in such cases the same rock-section may contain as many of the one kind as the other and all indiscriminately mingled together.



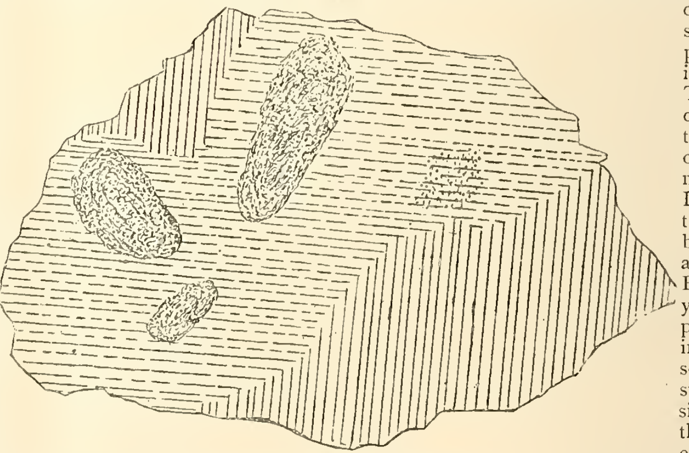


Figure 1 represents a fresh section of the brecciated ore, two feet high and a foot and a half wide, as exposed at the northeastern end of the drift from No. 4 shaft, Murray mine, in October, 1890, the shaded part being mostly chalcopyrite (with some pyrrhotite) and the rest fragments of diorite. The shaded spots in one of the latter on the right side are included patches of the ore. Figure 2 represents a section four feet high and three feet wide of the decomposed ore on the southwestern side of the railway cutting through the mass at the Murray mine. The shaded portion is the gossan with some undecayed pyrrhotite and chalcopyrite, the rest being fragments of diorite. Figure 3 represents a hand specimen of the ore from the Stobie mine. It was traced directly from nature and reduced to one-half the linear dimensions. The portion shaded horizontally shows pyrrhotite, the vertical shading chalcopyrite and the dotted areas rounded fragments of the silicious country rock.

Numerous analyses of the ores have shown that the nickel is confined to the pyrrhotite, in which it is present in the proportion of about 1 to 5 per cent.; but it has not been determined whether it replaces a corresponding proportion of iron uniformly throughout the mass or exists in the form of disseminated grains of polydymite. This mineral occurs as crystals, plainly visible in some of the ores from the Worthington mine, in the township of Drury.

THE GENESIS OF THE ORES.

The ore bodies of the Sudbury district do not appear to have been accumulated like ordinary metalliferous veins from mineral matter in aqueous solution, but to have resulted from igneous fusion. The fact that they are always associated with diorite, which has been left in its present positions in a molten state, points in this direction. As the diorite and the sulphides fuse at about the same temperature, they would naturally accompany each other when in the fluid condition. The bodies of molten diorite, being large, would remain fluid for a sufficient time to allow the diffused sulphuretted metals to gather themselves together at certain centers by their mutual attractions and by concretionary action. In the case of great irrupted masses of diorite, the bodies of ore which had formed near enough to the solid walls cooled and lodged with a mixture of the broken wall rocks where we now find them, while larger quantities, remaining fluid, probably sank slowly back through the liquid diorite to unknown depths. The causes which, at a subsequent time, favored the production of transverse dikes probably aided in determining the deposition of the ore near certain lines rather than elsewhere.

If we suppose that the molten sulphides abstracted themselves, by the laws of mutual attraction, from the general mass of the fluid rock and got together in considerable quantities in an intimately mingled form, the two kinds would tend by the same laws to separate themselves from one another, like going to like, just as salts of different kinds will separate into their respective crystals from an aqueous solution, because there is analogous action between mixtures liquefied by heat and by solution in a supersaturated menstruum. A study of the relations of the pyrrhotite and chalcopyrite to each other in these mixed ores and of the ores of the parent rock shows that this view is in accordance with the facts, and that it is probably a satisfactory explanation of the phenomena. No theory of aqueous deposition appears to account for the facts in connection with these ore bodies ; still we do occasionally observe limited local modifications of the ore which may have been due to the solvent action of water with subsequent precipitation of mineral matters long after the consolidation of the mass. This is more particularly the case with regard to the chalcopyrite. Crystals of quartz and of the felspars and rarely of apatite are found embedded in the ore.

EXTENT AND ASSOCIATIONS OF THE ORES.

Other metals, including gold, platinum, tin, lead, silver, zinc, and iron, have been found in the Sudbury district, and probably some of them may prove to exist there in paying quantities. The presence of a considerable proportion of nickel in the ore of the Wallace mine, on the shore of Lake Huron and in the strike of the Sudbury deposits, was ascertained by Dr. Hunt more than forty years ago ; yet the presence of this metal in the latter does not seem to have been suspected for a considerable time after they had been worked for copper alone. The Huronian is notably a copper-bearing system. West of Sudbury, in the great belt we have already traced, this metal occurs around Batchawana Bay, north of Sault Ste. Marie, at Little Lake George and Echo lake, at Huron Copper bay, in Wellington and Bruce mines, on Thessalon and Mississagui rivers, and elsewhere. To the northeastward it has been found on both sides of Lake Wahnapitæ, on Temagami and Lady Evelyn lakes, along Montreal and Blanche rivers, on the watershed east of the canoe route between lakes Temiscaming and Abbittibi, and finally near the southern extremity of Lake Mistassini. The search for this metal along the Huronian belt, which has been described above as running for more than 600 miles, is only in its infancy, and the copper-mining industry may some day be very extensively carried on in various parts of this, as yet, almost unknown section of Canada.

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The Londonderry Iron Company.—This Company has passed a fairly prosperous year, and has developed at Pugwash, Pictou, Brookfield and Niclaux valuable and important ore bodies as a reserve to their own mines. The New Glasgow Iron and Railway Company has secured the promise of a subsidy from the Local Government, and have commenced the construction of the branch railway to the East River Iron Ores. Indications point to a dividend next year by the Londonderry Company, their prospects being much brighter than in any previous year.

Meeting of the General Mining Association of the Province of Quebec.

The first general meeting of the General Mining Association of the Province of Quebec was held in the Windsor Hotel, Montreal, on Friday, January 30th, Hon G. Irvine, of Quebec, in the chair. There were present: Messrs. S. P. Franchot, Buckingham; J. Lavergne, M.P., Arthabaskaville; Col. Lueke, Sherbrooke; E. Wertheim, Black Lake; John J. Penhale, Black Lake; W. J. Poupore, M.P.P., Ottawa; W. H. Irwin, Adolph Lomer, R. T. Hopper, O. M. Harris, R. Prefontaine, M.P., Montreal; W. H. Jeffrey, Richmond; J. L. Wills, Ottawa; A. D. Cameron, Buckingham; W. Mackintosh, Buckingham; Capt. R. C. Adams, Montreal; James King, Quebec; Wm. Sclater, Montreal; E. Hanson, Montreal; A. W. Stevenson, Montreal; J. B. Smith, Buckingham; F. Hilton Green, Montreal; B. T. A. Bell, Ottawa, and others.

The secretary read the notice calling them together, and the minutes of the previous meeting, which were confirmed, after which the chairman, having explained the objects of the Association, invited those who had not yet joined to come forward and sign the membership roll.

This over, the draft constitution was taken up clause by clause, and after some amendment was adopted.

The objects for which the Association has been formed are "to mutually benefit and protect its members by facilitating the interchange of knowledge and ideas, and by taking concerted action upon all matters affecting or relating to the mining industries of the Province of Quebec, and generally to promote the said industries by all lawful and honorable means."

The Association is to consist of three classes, members, associate and honorary members, the first named being those engaged in the direction and operation of mines and quarries in the Province of Quebec, more particularly mine and mill owners, parties interested in the ownership of mines, mining engineers, mine managers, superintendents and metallurgists; the associate members are those not eligible under the foregoing clause, but who are considered worthy of admission to the Association, while the last consist of persons eminent in the profession or history of the industry of the Province. The office-bearers are to be a president, four vice-presidents, secretary, treasurer, and nine members in good standing, who shall act with the other office-bearers as a general council.

The annual general meeting of the Association will be held upon the last Friday of each year in Montreal, besides which, general meetings for the reading and discussion of papers and the transaction of other business, take place quarterly at such places as may be decided upon by the council. Special meetings may be called by the president at any time.

Consulting officers may be appointed at general meetings, and suitable remuneration may be voted them.

Such are the main features of the constitution as adopted.

This matter disposed of, the election of officers for the ensuing year was taken up, when the following were appointed without division: President, Hon. G. Irvine, Quebec; Vice-presidents, Hon. Geo. Drummond, Montreal; R. N. Hall, Q.C., M.P., Sherbrooke; Capt. R. C. Adams and R. Prefontaine, Q.C., M.P., Montreal; Secretary, B. T. A. Bell, Ottawa; Treasurer, A. W. Stevenson, Montreal; General Council:—James King, Quebec; S. P. Franchot, Buckingham; L. A. Klien, Black Lake; W. H. Irwin, Montreal; F. J. Falding, Sherbrooke; A. Lomer, Montreal; Col. Lucke, Sherbrooke; O. M. Harris, Montreal; and J. B. Smith, Glenalmond.

On motion of Capt. R. C. Adams, the following gentlemen were unanimously elected honorary members: Rev. Father Laflamme, Quebec; Sir Wm. Dawson, Montreal; Dr. A. R. C. Selwyn, Ottawa; Dr. T. Sterry Hunt, New York; Dr. R. W. Ells, Ottawa; Dr. B. J. Harrington, Montreal.

A vote of thanks was passed, on motion of S. P. Franehot, to Mr. W. J. Poupore, M.P.P., for his services on behalf of the mining community, and more particularly for his able and well directed effort in the Local Assembly to set aside government measures affecting the welfare of the industry.

The meeting then proceeded to discuss the Mining Bill.

At the outset, objection was raised to the presence of reporters, as it was doubtful whether it was advisable to permit of their deliberations being made public. The matter was debated at some length, and resulted in two motions, one that the proceedings be private, and the other that they be public. The latter was carried by a two-thirds vote.

The chairman then reviewed at some length the legal weaknesses and inconsistencies of the Act, pointing out the injury it would do the mining interests of the province, and read a draft petition which might be submitted to the Governor-General, praying either for an Order-in-Council vetoing the Bill, or for an opportunity of arguing their case before the Privy Council. Messss. Stevenson, J. Lavergne, M.P., Col. Lucke, W. H. Irwin, E. Wertheim and others gave their opinions on the subject, and it was then resolved that a deputation consisting of Hon. G. Irvine, Q.C., Messrs. R. N. Hall, Q.C., M.P., R. Prefontaine, Q.C., Capt. R. C. Adams, J. Lavergne, M.P., James King, B. T. A. Bell and Dr. C. Killing, should wait upon the premier of the province and state their views, and endeavor to make some arrangement regarding the Act before proceeding to extremities.

The meeting then adjourned.

Mr. S. J. Ritchie's Sudbury Project—Deputation to the Ontario Government.

A very large and influential deputation waited on Hon. Mr. Mowat on the 30th ult., with the object of impressing upon him the advantages that would accrue to Toronto by the location in that city of smelting and refining works, and to ascertain whether the Ontario Government would be willing to grant a bonus therefor. At least one hundred gentlemen were present, among others being Mr. S. J. Ritchie, of Akron, Ohio, the prime mover in the matter; Mr. J. Tait, M.P.P. for Toronto; Mayor Clarke, Ald. Lindsey, Allen, Phelps, Pape, Small, Maloney, Burns, Park, Farquhar, Bailey, Foster, Macdougall, Leslie. Representing the Board of Trade—President John I. Davidson, W. R. Brock, Thomas Long, Hugh Blain, G. M. Rose, Barlow Cumberland, William Ince, H. N. Baird, Robert Jaffray, R. W. Elliot, W. B. Hamilton, Elias Rogers, S. F. McKinnon, C. H. McLaughlin, John Brown, T. R. Clougher, Joseph Clougher, W. D. MeIntosh, Patrick Hughes, H. Lowndes, A. Stuttaford, G. E. Keith, H. V. Hutchins, George A. Cox, C. J. Smith, Ex-Ald. Davies. There were also present: Prof. Goldwin Smith, G. B. Smith, M.P.P., W. H. Beatty, N. G. Bigelow, T. C. L. Armstrong, George Dunstan, J. C. Hurst, Arch. Blue, Edgar Jarvis, Ex-Ald. G. S. Macdonald, J. Ross Robertson, Major Greig. Mr. Mowat was assisted by Hon. A. S. Hardy in receiving the deputation. Mayor Clarke, of Toronto, introduced the object of their visit. They had come, he said, representing the City Corporation, the council of the Board of Trade, and a number of the property owners of the east end of the city, to request the Ontario Government to co-operate with the Dominion Government in giving aid to promote the establishment of the necessary works for the proper development of the rich nickel deposits of the Sudbury district. If the iron mines at Coe hill were connected by rail with the nickel mines at Sudbury, the two industries could be brought together and could be developed by the same establishment. He believed that Mr. Ritchie had obtained promises of assistance from the Dominion Government, and if the Attorney-General and colleagues would co-operate with the Dominion Government it would greatly aid the project. They asked for a bonus of three per cent. of the expenditure that the industry would make, which would amount to $1,500,000, spread over a period of 10 years. This briefly was the object of the interview, which Mr. Ritchie would more fully explain.

Mr. Ritchie had a paper prepared on the question, which he proceeded to read. On November 10 last he had addressed the Dominion Government, asking aid for the extension of the Central Ontario Railway from Coe hill to Sudbury. He also asked the Government to pay the interest at the rate of three per cent. per annum for a period of 10 years upon a capital stock of $5,000,000 to be used for the building and working of a steel plant for the manufacture of nickel steel in Canada. He had then pointed out some of the inducements, the advantages and the benefits which would result from establishing so great a new industry in this country. When that petition came to be considered, it was pointed out that all the industries for which he was asking aid were located in Ontario. The building of the railway, the mining, treating and smelting of the ores, and lastly—the most important of all—the manufacture of the pig-iron and the nickel into all the higher forms of steel and alloys of nickel and steel, were all in this province. It was therefore suggested that as Ontario was to be so largely interested, she should do her share to aid the enterprise. He had accordingly modified his request to the Dominion Government to aid the railway, and asked the Ontario Government to grant the aid to the steel plant formerly sought from the Federal authorities.

In order to show the importance of these works he had only to point to the magnitude of similar works in the country nearest to Canada. Take the pig iron of the United States. If the Grand Trunk railway were to devote all its energies to the carrying of the pig iron there manufactured, and to lay aside all its other freight, it could transport only 80 per cent. of the whole product. If the Canadian Pacific were to do the same it could carry 60 per cent. It would have required nearly the combined energies of the two companies to have handled the coke consumed in reducing this vast amount of ore, while the limestone used in smelting was equal to one-half of the Grand Trunk's tonnage.

If in the United States the mining and manufactures of this ore were to cease, every railroad in the States from which the iron was mined would become bankrupt. The carrying trade would disappear from the lakes, and ships would rot at their moorings.

In Canada they had all the interests that go to make these works possible and profitable. It was the metals that made the wealth of a country. If Great Britain were to close her mines and the workshops fed by them, she would perish both on sea and land, while Belgium, with her mines stopped, could not subsist for longer than 18 months.

"How is Canada," continued Mr. Ritchie, "to grow and support a great population? She will never have it while she neglects to utilize her principal asset—her great storehouse of wealth which nature has placed for her in the earth and which requires men's labor to bring it out. You are already face to face with the problem: 'What shall we do to give employment to our surplus labor?' 'What new fields are there for those who are capable of and are disposed to employ labor?' The old avenues are already full and running over. The bare statement of the fact that such a state of things as this should or could exist in Canada to-day is something startling, doubly startling when made in connection with the fact that at this moment you have a population of very much less than two human souls to the square mile of your vast empire. You are thus at one and the same the greatest mineral country and the most sparsely populated country upon the globe. What a contradiction of possibilities, and the state of things which should result from such possibilities. Is there not something wrong, is there not something radically wrong in all this? Where is the remedy? You must furnish it if one is to be furnished. Your own people will not go into new and large undertakings without some guarantee from the Government, and very few of them are disposed to do it even with such guarantee. You can hardly expect your neighbors or the people of other countries to have more interest in you and in your welfare than you have in your own welfare. If there is any risk to be taken, and there is a risk in all business, who is so well able to share that risk as the whole people represented by its Government. Especially when it is proposed to bring in a large amount of foreign capital and the great bulk of the earnings of that capital and the earnings of the labor employed by it are to be distributed among, and to remain with your own people. The whole amount asked from your Government in aid of this enterprise is one and a half millions of dollars distributed over a period of 10 years. This does not look to be a great burden for a province which is almost an empire in itself. If this industry should prove even as remunerative as like ones have done in other countries the province would have received back its money long before it had expended it."

Replying to an objection that might be made that the enterprise was a private one, Mr. Ritchie pointed to the attitude of the United States Senate Committee on Foreign Relations towards the Nicaragua Canal and the bounty the United States Government offers by the McKinley Bill upon the production of sugar.

It would not be necessary for him to remark on the value of the deposits at Sudbury. These matters were so well known that they required no further proof. It was only recently that a man thoroughly informed on ship-building in the United States, had said to him: "If we only had these Canadian nickel mines in this country we would move the ship-building interests from Great Britain to the Atlantic seaboard." "And I now," remarked Mr. Ritchie, "say to you that if Canada were half awakened to the importance of her position she could remove the bulk of the ship-building interests from the banks of the Clyde to the banks of the St. Lawrence. Do you think such a result would be worthy of any government aid or effort? It seems to me it would. Even poor Ireland has built the magnificent White Star line of steamers upon her own soil."

The project of bridging the English channel was now being seriously discussed, and he had now in his possession plans for the proposed structure from Schneider & Co., the owners of the great metal works at La Creusot France. Of this project a prominent English engineer in a letter to him said: "If this bridge is built, as it is likely some day to be, nickel steel would be the material used. Canada would have to supply this material; no other country could furnish it."

"It would indeed be strange," continued Mr. Ritchie, "if the metals found in so forbidding a looking place as Sudbury should make it possible for English and French railway trains to run backward and forward over a bridge more than twenty miles long, spanning the English Channel and linking together the two countries by bonds of steel. To show you that these statements are not visionary, I attach a statement from the Paris correspondent of the London *Times* giving all the soundings and much data in connection with the enterprise. It may some day in the not distant future have peculiar interest to Canada and to the Government of Ontario. If your Government sees its duty as I see it from the outside, ship plates, made of nickel steel for transatlantic steamships, could successfully be made in Canada. There is not a doubt that they would soon be made here if the Government takes hold and aids this enterprise. There is just as little doubt that they will not be made here without the Government's aid. There is no doubt that the output of a very large establishment for the manufacture of nickel steel could be readily sold in Europe to-day at very remunerative prices.

"Engineers and metallurgists of the highest authority declare that the discovery of the qualities of the alloy of nickel and steel is an event not second in importance to the discovery of Sir Henry Bessemer, which was nothing more than burning the carbon out of cast iron and re-carbonising it with a little manganese. The man who could and would have told the far-reaching importance of that invention at the time it was made would have been pronounced a madman. Suppose one country had had the power to utilize the importance of that invention almost wholly for her own benefit by giving some governmental aid to support and carry on the enterprise, do you think any metal-producing country in the world could have been found which would not gladly have done it? Is it desirable that Canada shall share in the profits of nickel steel manufacture, and in the numberless industries that will grow up around, branch out from, and send their life-giving influence into all her avenues of trade? If she gives her aid to establish this industry, $12 will be expended in the country where $1 is being expended under present arrangements."

Several other gentlemen then gave their views on the subject. Mr. Davidson, president of the Board of Trade, said that on behalf of that body he asked the Government to concede the required guarantee. He did not ask the Ministers to give a definite promise until the *bona fides* of some company had been presented to them. All that they asked was an intimation that the Government would, under these circumstances, do what was required of it. Mr. Tait, M.P.P., and Prof. Goldwin Smith, spoke of the benefits that would result to Toronto from the establishment of a steel plant there. Mr. W. R. Brock was of opinion that what the province needed was population, and the development of this industry would certainly increase it to a material extent. Mr. T. Long followed in the same strain, and stated that he believed that the leader of the Opposition, Mr. Meredith, would accord his support to the project.

Several other brief speeches were made in the same strain by other members of the deputation.

In reply Hon. Mr. Mowat expressed his pleasure in meeting the deputation in connection with a subject the importance of which he and his colleagues fully appreciated. He had listened with great interest to the various observations, and would give the matter the most careful consideration.

The Mayor, on behalf of the City of Toronto, stated that the Corporation was ready to assist the project, after which the deputation withdrew.

British Columbia Mineral Bill.

A mineral bill has been introduced in the British Columbia Legislature by the Hon. Minister of Mines, dealing with minerals in veins and lodes only, but which will shortly be followed by another concerning placer mines. The bill gives evidence of wise and careful consideration; several important changes from the existing law are proposed, but the main outlines are the same; both are modelled upon the American mineral laws, but have a number of distinctive features, and in the new act there are many explanatory clauses as a guide to the miner in ascertaining his exact rights.

The revision of the mining laws was entrusted to a commission, and this is the first product of their labors. That they have conscientiously performed their duties will be seen in the accompanying summary of the bill, which retains all the best features of former laws, without those that have been found to he objectionable; it is liberal to the miner, yet very strict in specifying the manner of acquiring mining rights; unnecessary repetitions have been avoided, as have unfamiliar legal terms, the language throughout being plain and simple; and the whole bill seems well adapted to the mining wants of the province, and on the presentation of which the Minister of Mines should be congratulated.

The act is divided into eight parts:

Part I. treats of miners' rights. Upon purchasing a miner's certificate, any person or any properly organized joint stock company, has the right to enter upon, locate, prospect and mine upon any Crown lands, for all minerals, precious or base, other than coal. This right also extends to any lands which may hereafter be deeded by the Crown, lands which have hitherto been alienated by Crown grants, and in which only the precious minerals have been reserved, are open to miners to work for the minerals only; the exceptions are lands occupied by any buildings, orchards, land actually under cultivation, and Indian reservations. For any damages done to prior owners full compensation shall be given to the satisfaction of the Gold Commissioner previous to such entry.

Part II. specifies the method of locating, recording and making claims, and the method of obtaining Crown grants therefor. The location, where possible, includes a spot of land 1,500 feet by 600, with parallel end lines and in rectangular form. The centre line shall be straight, and clear directions are given as to the numbering of the stakes and the notices which shall be placed upon them. Locations made upon Sunday are not thereby invalidated. Priority of location constitutes priority of right. A record of such location must be made with the Mining Recorder within fifteen days after such location. After such record is made the holder of the claim shall perform upon such claim one hundred dollars of work within the first six months, and shall obtain from the Mining Recorder a "certificate of work," and shall record the same—first satisfying the Recorder that such work has been done by an affidavit, stating the details of same. This shall entitle him to hold the claim for an additional six months, constituting the first year's tenure of the claim. During each succeeding year the same amount of work shall be performed in the first half of such year, and a similar "certificate of work" obtained and recorded. This is in lieu of the former system of recording claims annually. No miner can hold more than one claim by location upon the same vein, but may purchase others and may locate upon other veins, and after abandoning or forfeiting any claim cannot re-locate any portion thereof without first obtaining the written permission of the Gold Commissioner, nor can he be interested in any such location.

The rights which a miner obtains by such location are set out very clearly, including all the lodes which have their apex within his location, with the privilege of following them downwards on the "dip" even if it carries him outside the vertical planes of his side lines. Lengthwise upon the vein, however, his rights are bounded by parallel vertical planes extended downwards indefinitely. When veins intersect each other the prior location is entitled to all the ore at the point of intersection and thence downward. When a tunnel is run for the development of a mine, the owner has the right to locate all veins discovered in such tunnel, if not previously located. The interest of a miner in his claim is a chattel interest, equivalent to a lease, during the time when it is in existence.

A Crown grant can at any time be obtained by paying twenty-five dollars per acre for his claim, but his intention to apply for a grant must be advertised for 60 days. If, however, the holder of a claim desires to expend five hundred dollars upon development, he can get his Crown grant without payment of that sum by obtaining a "certificate of improvements" from the Gold Commissioner. Three forms of Crown grants are given in the Act,—one applying to unoccupied Crown lands, another to lands granted in fee simple in the future, in which the right to mine has been reserved to the licensees of the Crown, and the third to those lands now owned by others, in which only the right to mine for gold and silver has been reserved. In the two last forms the surface rights of the prior occupant are specially protected.

When there is an adverse claim, legal proceedings must be brought and prosecuted continuously, and the adverse claimant must file plats of such entire adverse claim to show the ground in dispute. When final judgment in any such suit is rendered, it shall be the basis for the issue of a Crown grant. Any transfer of a mineral claim must be in writing, and must be recorded, and if any claim is held by Crown grant such transfer shall be by deed and under seal. In case of the death of a free miner his claim shall not be open to location during the period of his last illness, or for twelve months after his death.

Mill sites, not exceeding five acres, can be located by a free miner upon ground not known to contain minerals, as nearly as possible in the form of a square. After sixty days' notice given of such location, upon complying with certain conditions, the locator shall be entitled to a year's lease of such ground, during which year he shall erect works or machinery upon such mill site of the value of five hundred dollars, and shall then be entitled to a Crown grant of the land, for five dollars per acre. Such Crown grant shall give no title to any of the minerals if such should afterwards be found to exist.

The Gold Commissioner shall have power to grant to any free miner a license to run a drain or tunnel across occupied or unoccupied lands, upon such terms as he shall see fit. He can also grant water rights to any holder of a mineral claim or of a mill site, for a term not exceeding twenty years. Such water right shall not entitle the grantee to sell such water, and shall cease when the use for it ends, by the abandonment of the mine or mill-site in respect of which it has been granted. The grantee shall commence the construction of the ditch for conveying such water within six months from the making of the grant, and shall not waste the water under pain of forfeiting the grant. If the Gold Commissioner sees fit, he may extend the grant for a period not exceeding ten years, if the use for such water still continues.

Part III. treats of mining partnerships, which are deemed to exist from year to year, without written articles of agreement. If any partner fails to keep up his free-miner's certificate, his interest becomes vested in his co-partners. A majority of the interests in such partnership shall decide when and how long and in what manner the partnership claim shall be worked—and a manager may be appointed who shall have power to bind them by his contracts. Assessments are made payable within thirty days after being levied, and default in any partner in payment authorizes the partnership to advertise and sell the interest in default. A partnership can register itself in the Mining Recorder's office as a "Limited Liability" company, and post these words in a conspicuous portion of its claim: after which no partners shall be liable for any of its indebtedness, beyond his proportional interest in the partnership. Its books shall be carefully kept, and always open to the creditors, and no dividend shall be declared until all its liabilities shall have been paid. The foreman, or manager, or an agent authorized in writing, alone can contract any indebtedness.

Part IV. treats of the duties and powers of Mining Recorders. Each one shall issue free miners' certificates, and shall keep books called "Record Book," "Record of Abandonments," "Record of Affidavits," and "Record of Conveyances." In the last three books all entries shall be made by copying the documents entered therein *verbatim*. In the "Record Book" shall be entered records of locations, certificates of work, certificates of improvements, extensions of time, licenses, water grants, forfeitures, abandonments and all judgments affecting mining property. Copies of or extracts from these records, duly certified by the Mining Recorder, shall be evidence in all courts in the province. If any miner makes affidavit that stress of weather or other sufficient reasons prevent him from doing his annual assessment work within the six months specified, the Gold Commissioner or Mining Recorder may extend such time not to exceed six additional months. The Gold Commissioner may at any time perform all the duties of the Mining Recorder.

Part V. treats of the ministerial power of the Gold Commissioner, which have nearly all been designated in the foregoing sections. He can empower a free miner holding adjoining claims to perform upon one the assessment work due upon all, and shall receive all documents and moneys necessary for the issuance of crown grants, and forward the same to the Commissioner of Lands and Works. He shall take charge of the property of any intestate deceased free miner, and administer upon the same.

Part VI. gives jurisdiction in mining disputes to the county courts, and enumerates their various powers, and the course of proceedings in all actions.

Part VII. treats of the punishment to be visited upon any one contravening this Act, and the collection of fines and penalties, and states before whom affidavits and declarations can be made—among them is included the Gold Commissioner and Mining Recorder.

Part VIII. repeals the former Mineral Acts, and clauses in other acts which conflict with the present one.

Surface Geology of the Pictou Coal Field.*

BY H. S. POOLE, F.G.S., ETC., STELLARTON, N.S.

Boulder clay covers large portions of this field; it often contains pebbles of the rocks immediately underlying, mixed with fragments of those passed over by the ice flow from the higher ground lying to the south and south-west, and with occasional boulders well rounded and travel-worn of still older rocks from more distant localities.

One of the largest of these known in the neighborhood lies on the edge of the Pictou Town Branch Railway, near Stellarton, and must weigh not less than forty tons. Some of the smaller are striated, but much of the rock of which the pebbles and boulders in the clay are composed is of too perishable a nature to retain surface markings after exposure to the elements, and striæ are rare.

In the clay there are frequently found grains and small pebbles of coal, which there is every reason to believe are from the outcrops of beds proved to be close at hand, and these, it is noticeable, have their edges rubbed off as from exposure to much abrasion although removed but a comparatively short distance from their parent source.

In places the clay has been cut through, and the outcrop of soft measures in a friable condition exposed—the dark shales, coal and fireclays appearing in the clay as darker streaks, which gradually take on the character of individual beds decomposed in lessening degree until a compact form is acquired, and although the direction of the outcropping may be contrary to that assumed for the flow of the drift, no folding hack of the streaks has been noticed in the sections.

Thin beds, or partings of sand, are occasionally seen in the clay, and streaks of various tints of red may be detected.

One interesting drifted fragment was observed on the side of the abandoned Drummond railway, passing through the lands of James Cameron.

In making a drain outside a cutting at this point broken coal and black shale were turned up, so trial-pits looking for a possible seam of coal were, in consequence, put down. But instead of the expected coal measures the excavations only showed a mass, a couple of feet thick, thirty feet or so wide, of coal and shale partly imbedded in the clay, which in turn rested on undisturbed mottled, reddish beds of the millstone grit series; the probability being that this particular mass of broken measures had drifted from a point southwestward, half-a-mile or more from where it was found stranded.

The drift in some parts lies in well-defined ridges, gently rounded and coursing in the western portion of the coal basin about N. 40° E. The parallelism of the ridges west of Stellarton is well marked, and their course seems entirely unaffected by the elevation and direction of the subjacent surfaces. It was at first supposed that the ridges near the river may have been old banks of the stream when it flowed at higher levels; closer inspection made it clear that there had been no such erosion as a river bears on the face of its banks, the sides of the ridges being equally rounded and uniformly graded. These ridges may be seen on both sides of the river, where it enters the coal basin, and on the flank of McGregor's Hill, in a series of elevations, some seven in all, having very much the appearance of river terraces.

It is also evident that the depressions between adjoining ridges are not due to subærial denudation, the area drained in many cases not being sufficient to supply the necessary flow of water to mould the surface into its present form, and this opinion is strengthened by the knowledge that it is not a characteristic of mining water to traverse a country in straight lines. Some of the depressions are at times water-runs which do not confine themselves to one course, but in places break through to an adjoining depression, the deviated course apparently following the strike of some underlying stratum of soft or friable material. And at such places the extent of the denudation, where not only has the boulder clay been washed away but the older formations have been further eroded, may be taken as some gauge of the time since the present condition of things began. One of the more convincing evidences of the glacial character of these ridges is a depression perfectly straight from the slightly raised centre of which water flows, when there is any to flow, in diametrically opposite directions.

To the mineral explorer a knowledge of the nature of these deposits leads him to sink his trial-pits in the lower ground where he may expect to find the surface offer less depth than on the crest of the ridges, and this knowledge is of no small value in the field under review since the excessive thickness of the diluvium is in many parts a great bar to the study of the structure of the older rocks beneath. Twenty and thirty feet is a common depth, while sinkings sixty and even eighty-six feet have failed to pierce these deposits. The deepest spots are where it is supposed the river and larger brooks at one time ran previous to the deposition of the drift. The position of these beds of drift is also a matter of no small worth to the railway contractor, for there have been several instances where men accustomed to the soil of other sections of country have been disagreeably surprised to find the cost of earthwork in Nova Scotia far exceeded their estimates and experience elsewhere.

After the agreement in 1858 between the Local Government and the General Mining Association threw open the unreserved mineral lands to other lessees, an endeavor was made to trace the coal beds outside the Association's areas, but beyond a few chains distant this endeavor to the westward was for many years a failure. West of a certain line, the depth of the surface material was found to suddenly increase, and several trial-pits and bore-holes were abandoned when they failed to reach the rock at forty feet and more. This western limit of shallow drift probably indicates the eastern bank of McCulloch's Brook in pre-glacial times, and studied in the light of our present knowledge of the underlying strata, it marks also the eastern side of the McCulloch's Brook fault—that great dislocation* of some 2,600 feet which separates the Westville from the Albion field, and down tilts the former in the direction of the latter.

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* Paper read before the Nova Scotia Institute of Science.

The influence of this fault on the surface configuration still remains, on the one hand a uniform slope towards it, on the other ranges of low hills abruptly terminating against it.

In the pre-glacial stage of its existence, the brook doubtless flowed at a lower level than at present over part of its course, and as erosion proceeded, and influenced by the inclined strata on the one side, it pressed eastward against the broken measures of the fault, or crossed over and skirted the Albion section.

After the deposition of the glacial drift ceased, and the brook renewed its existence, and in part guided by the form of the ridges already referred to, and partly by the general trend of the old contour not entirely obliterated by the new coating it had received, it began again its work of erosion at a higher level than at which it left off, and it traversed almost, if not altogether, on the eastern side of the fault in question. To what extent the fault and the old bed of the brook coincide can only for the present be conjectured, but as the working of the Westville collieries proceeds into the improved ground, it cannot be long before the actual position of the great break will be determined at one or more points along its course.

If the theory be tenable that it was the ancient brook that made the valley, now filled so deeply with drift, it is equally probable that the depth of clay, 35 to 70 feet thick, near the railway station at Stellarton, indicates that the river channel in pre-glacial times ran under what is now its left bank, and flowed in a course to which its deviations to and fro across the broad interval have not since restored it.

In Acadian Geology, page 61, it is stated: "A very large proportion of the present feature of the surface is due to the denudation in the production of the boulder deposits. The ridges of Cumberland, the deep valley of Cornwallis and Annapolis, the great gorges crossing the Cobequid Mountains and the western end of the North Mountains in Annapolis and Digby Counties; such eminences as the Greenhill in Pictou County, and Onslow Mountain in Colchester, are due in great part to the removal of soft rocks by denuding agencies of this period, while the harder rocks remained in projecting ridges. On the other hand it might be shown that many masses of rock which once projected above the surface have been greatly diminished or entirely removed." This supposition, that the glacial was a period chiefly of denudation, the deposits being little more than sufficient to leave a record of its existence, is somewhat at variance with that already implied in this paper. But while there can be no doubt that denudation in part was a result of the glacial period, and the rounding of the Atlantic coast hills certainly effected by ice in that and probably similar periods of previous ages, observations in the small section of country now under consideration seem to point to other conclusions, at least with regard to part of its configuration.

Some influence other than relative hardness of the strata to resist the abrading influence of ice would seem to have been at work in determining the positions of the hills and hollows. Take the case already referred to, the conjectural ancient valley of McCulloch's Brook, it is not easy to suppose that ice in any form could have plowed it out, and worked in a deposit 60 and 80 feet thick, and at the same time left at levels two and three hundred feet higher measures of much softer texture. The conditions observed would be more readily accounted for by imagining that the face of the country previous to the drift period had very much the same general contour that it has to-day, though somewhat less reduced in height no doubt, and that that contour was acquired by subærial denudation subsequent to the period of stratigraphical disturbance.

It would seem to be something more than a coincidence, the association of lines of lesser elevation and well marked dislocations. The bed of the east river follows through a very broken section of ground, the entrance into, and the exit from, the basin of other water courses are invariably associated with disturbed strata, and if it be rightly inferred that in the shattered rocks of dislocations subærial agencies would exert most influence, the association of the two is readily explained.

On the other hand, if it is assumed that the inequalities of the surface have been formed by the action of ice and marine currents, the reasoning applied to the clay ridges should be applicable to the hills and hollows, and approximate form and direction in rocks of uniform texture might fairly be expected.

This is not seen in the pre-glacial surfaces, which have been protected from subsequent erosion by the covering of drift.

But the faults that have circumscribed the basin and severed it into sections, would rather appear to have been the primary cause for the hills and hollows assuming their present form under the hand of agents conveniently classed as subærial, acting through the ages that have been since the time when elevating and lateral pressures broke the uniformity of the carboniferous strata. To clearly show this would require the field to be carefully mapped and contoured, which, unfortunately, has not yet been done. Such a map would further show that the highest beds in the Marsh pit series, in fact the highest in the coal measure, is at the lowest elevation above the sea in the eastern section of the basin, and is overlaid by a small pond in shape of an arrow-head, whose edges are parallel to the strike of the strata on two sides of a subordinate fold.

Annual Meeting of White's Asbestos Company, (Limited).

The first annual general meeting of White's Asbestos Company, (Limited), was held on December 30, in London, Eng., under the presidency of Mr. John H. Hamilton, (the chairman of the company).

The SECRETARY (W. M. Borradaile), read the notice convening the meeting. The report and accounts were taken as read.

The CHAIRMAN: Gentlemen, the brief report which was sent to the shareholders accompanying the notice calling this meeting, will have prepared them for an unsatisfactory statement regarding our position, and those of them who have read the account of our suit against our largest shareholder, to recover the amount due for calls on his shares, will have had confirmation of this, as full particulars came out at the trial. I shall refer to this latter before concluding my address to you, but must first give you an account of what has happened since our last meeting. In the month of March we summoned a special general meeting of shareholders to meet Mr. Boyd, in order to learn what he had to say regarding the position and prospects of our properties. At that meeting I told the shareholders that the board had been much disappointed with the progress made in development during the previous summer, which was to some extent accounted for by the extreme wetness of the season and the protracted illness of Mr. Boyd at the most favorable time for working—an illness extending over nearly two months, and culminating in the necessity of undergoing a most serious operation; but I acknowledged, as did Mr. Boyd, that it was now evident that, under the most favorable circumstances, his prediction that we could be marketing any considerable quantity of asbestos within three months of commencing operations, could not have been fulfilled. I further said that if the meeting had been held two months earlier, and the shareholders had expressed a wish to discontinue operations, I should not have felt justified in dissuading them, but I intimated that from what we had learned from Mr. Boyd with regard to the foliated veins in the Coleraine property, and from the analyses we had of the rock containing them, the board had come to the conclusion that it was most desirable to prosecute the work at this point, which promised very satisfactory results. Mr. Boyd gave a full description of the nature and extent of these foliated veins, and the shareholders, having heard his explanations, passed a cordial vote of thanks to him, and it was decided that he should at once return to Canada and commence operations as soon as the snow had disappeared. He did so, and a short time after his arrival sent us three tons of asbestos from these veins, which had been crushed by a "cyclone" crusher. This small shipment contained a considerable quantity of sand, which could easily have been separated from it by machinery. In its then state it was only worth about £8 per ton; but Mr. Fowler carefully washed a portion, and on the samples so obtained we had offers for considerable quantities at £13 per ton, and from the anxiety shown by the buyers to make a contract, I gather that a higher price might be obtained. Even £13 would have paid very well indeed, as the cost of machinery for crushing and washing would have been small. We put ourselves in communication with Messrs. Fraser, Chalmers & Co., of New York, to whom we instructed Mr. Boyd to send a ton or two of foliations in order that they might advise us as to the best means of preparing it. They sent us samples of the results obtained by them; but these, though cleaner than the three tons sent by Mr. Boyd, were not so satisfactory in other respects, as the fibre had been broken by the crusher used by them, so that the staple was shorter.

While these experiments were being made, Mr. Boyd had our instructions to go on extracting as much asbestos as possible, and to adopt means for freeing it from foreign substances, and he wrote us frequently that he was doing so. We pressed him, mail after mail, to report progress, but our letters brought no satisfactory explanations, and at last we learned the truth, that he had been spending the greater portion of his time in Quebec, and entirely neglecting his work at the mine. The only possible excuse for his absenting himself from the mine was that he was trying to arrange to lease some other properties, with a view to immediate returns. We discouraged this, as we wished him to devote his whole time to our own property. However, on pressure by some of our Canadian shareholders, we consented to Mr. Boyd's taking leases on certain conditions on his assurance that the work would be under the management of an experienced miner, which would leave him free to attend to our own properties. The conditions we stipulated for were long leases with a moderate royalty and option of purchase. When the leases—which had been taken in Mr. Boyd's name—arrived, we found that they were for one year, and the proprietors retained the option of cancelling in the event of their selling the property. We, of course, declined to sanction any such agreement on behalf of the company, and passed severe strictures on Mr. Boyd's conduct in this and other matters, in consequence of which he resigned and his resignation was accepted. We are at a loss to account for the change which came over Mr. Boyd at this period. He is undoubtedly a man of great ability and immense energy, as the shareholders must have seen for themselves when they met him. We know that he was again suffering from the same disease which nearly proved fatal the previous year, and can only suppose that this unfitted him for the hard, plodding work at the mine. He ought, however, to have had no difficulty in finding someone to carry it out under his instructions. It was in the month of September that Mr. Boyd resigned, and as it was impossible to supply his place at once, the board gave instructions to close the works for the winter, with a view to calling the shareholders together as soon as the accounts to the end of September were received. Before leaving this subject I may say that the directors have no reason to change the opinion they had formed that the Coleraine property, which is the only one on which they have worked to any extent, will, when the necessary machinery is provided, pay well. Had the company gained their suit against Mr. Hoare, their resources would have amounted to about £5,000, and the directors would have recommended the shareholders to go on; but the result of the suit, coupled with the backwardness of the shareholders in paying their calls, has crippled their resources, and it is for the shareholders to say what course they wish to adopt under the altered circumstances. I now come to deal with the question of our suit, regarding which I must say a few words, though I shall leave it to our solicitor to explain any legal questions connected with it. We were so utterly unprepared for the result, as were our solicitor and counsel, that we, perhaps, did not bring forward all the evidence we should have done on several important points which seem to have influenced the judge. Had we done so, he could not have given the reasons he did for his decision, and the result of the trial might have been very different. He was evidently impressed with the idea that this was what the Americans call a "wild-cat scheme," got up by wily vendors and promoters, with the assistance of too credulous directors, for the purpose of wheedling money out of the public for their own benefit. He was good enough to except the directors from such an accusation, as he stated more than once that their honesty and honor were not impugned.

Now I will tell you who the promoters of this scheme were. Mr. White, the vendor, who has since died, was a gentleman of position and standing in Quebec, who had married a daughter of Sir Hugh Allan, was a trustee or director of the Allan line of steamers, and was in intimate relations with all the members of the Government and State officials; and Judge Irvine, who is well known here, and happened to be in London when the company was formed, told me that he was a thoroughly honorable man, and one who was incapable of making an untrue statement. This I believed, and nothing that has since happened has in any way altered my belief. This gentleman (Mr. White) employed Mr. Boyd, a mining engineer (not a mechanical engineer, as stated by the judge), to go to the asbestos districts, which were then exciting considerable interest in Quebec, and to select desirable properties with a view to their purchase from the Government. Mr. Boyd, accompanied by several prospectors and experienced miners, and 29 men, visited the district and spent four months or more in examining land extending over eight or nine square miles of country, making openings at various points in properties extending over an area of 2,000 acres, and finally selecting the properties which have since been acquired by the company. Mr. Boyd, who was selected, was not a "mechanical engineer who had once seen specimens of asbestos in a museum" (as the judge sarcastically remarked). He had worked in shops, as I presume most mining engineers do at some period of their training; but it was as a mining engineer that Mr. Fowler had known him during a period of seven years in Spain, and that gentleman stated in his evidence that he had formed the highest possible opinion of his character and capacity. Mr. Boyd has written a pamphlet on the subject of asbestos and asbestos mining, which displays very considerable knowledge of the subject, both from a scientific and practical point of view, and it is very probable that this was Mr. White's reason for selecting him. Then as to Mr. Fowler, who became the promoter of this company (and of whom the judge said, without a shred of evidence, and, in fact, in the face of distinct evidence to the contrary, that he was probably interested in the scheme from the first), I would like to explain, that when Mr. White came to London with a view to forming a company, he was accompanied by Mr. Boyd, who from his previous acquaintance with Mr. Fowler, naturally introduced him to that gentleman, in order to obtain his assistance and advice. There was no intention at first, or even when the matter was first brought to the notice of the directors, that Mr. Fowler's position should be other than that of consulting engineer; but owing to Mr. White's state of health, he was quite incapable of undertaking the negotiations connected with the formation of the company, and Mr. Fowler agreed to become the promoter on condition that he should receive a sufficient amount in cash to cover his expenses. I was not personally acquainted with Mr. Fowler before this matter was brought to my notice, but made enquiries as to his position, character and standing, the result of which was so entirely satisfactory, that I had no hesitation in accepting his assurance, which we had in writing, that we might place implicit reliance on Mr. Boyd's report. I did this more readily as Mr. White, of whom we had received so high a character, fully confirmed Mr. Fowler's opinion. I now come to deal with the articles in an evening newspaper, which appear to have created so strong an impression on the mind of the judge. The directors did not, as he appears to think, proceed to allotment without having fully considered the allegations contained in the first article. Their first step was to summon Mr. Boyd, who was in Ireland, by telegraph, and on his arrival they went fully into the whole matter with him and Mr. White, and the explanations they received were so completely satisfactory, that they decided there was no ground for postponing the allotment. Before receiving Mr. Boyd's explanations, that gentleman, accompanied by a friend who had been asked to go with him, waited on the editor of the newspaper in question, and their report of the interview was that he thanked Mr. Boyd for his frank explanation, and said that he must have been misled. If you have seen the articles referred to you will observe that in the second one after his interview with Mr. Boyd any points on which the writer disagrees with that gentleman are stated more as matters of opinion than of fact.

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* Mr. Hartley in the Survey report for 1869, gives it as 1,600 feet only.

The only other matter which appeared to us to have exercised an undue influence on the judge's mind was the difference between the original cost of the properties, and the price paid for them by the company. This could not, of course, have been a ground of relief to the defendant, as the original purchase price was fully stated in the agreement, which intending shareholders were invited to inspect; but the judge commented so strongly on this that I think it well to offer a few explanations. Three out of four of these properties were acquired from the Government, at the price and on the conditions on which mineral lands are sold. Of course, to have purchased such lands, and without further trouble, expenditure or investigation, to have simply came across the Atlantic (as the judge seemed to imply was all that had been done), and sell for £45,000, what cost less than £1,000, would have been a very extraordinary proceeding; but Mr. White, having obtained large options of land, sent out a prospecting party, consisting of 30 men, with Mr. Boyd as leader, who spent four months inspecting land, eight or nine square miles in extent, and making openings in properties having an area of 2,000 acres, from which the properties acquired by the company were selected. It is clear that the value of such lands, when selected and proved, bears no proportion to that of the same lands before they are tested. I cannot tell you what the cost of this expedition was, and what Mr. White paid for the options he secured. I am told that it was about £3,000, but I have no means of verifying this. The expenses, however, must have been considerable. Then, gentlemen, it is absurd to talk of £45,000 as the price paid for the property. The cash payment was only £6,000, out of which the expenses of forming the company had to be paid. Taking this at £4,000—and it could not have been less—the real cash received by the vendors was some £2,000 less than their out-of-pocket expenses. Then you will observe, gentlemen, from the accounts you have received, that the actual amount paid the vendor in cash and shares has been reduced to £35,000 instead of £45,000, and the real amount is only £32,000, as, by an arrangement with Mr. Fowler, which appears in the minutes some months ago, he has agreed to reduce his interest by £3,000. As regards Mr. White, it is clear that the amount of cash received by him was at least £2,000 less than his actual outlay, besides which he has subscribed and paid for 2,100 shares. This shows the confidence he had in the value of the property, as his whole interest depended on the success of the company. Well, gentlemen, you have had our report and accounts, and if there are any questions to be asked, I shall be happy to answer them. I do not know that I have any more to say, but I shall be glad to hear from the shareholders what view they take of the position and prospects of the company, and what they consider should be done in the future. I know from letters that we have received that there is some hostility on the part of some shareholders; but what we should like is that the shareholders should appoint a committee of two or three of their number to meet the directors, and we should be happy to go into all matters, and act on their advice. I now move the adoption of the report and accounts.

In reply to Mr. G. Dunsmuir, the Chairman said Mr. Richman retired from the board on April 2.

Mr. Ems said, if in order, he would move that the company be wound up, and a committee be formed to consider steps for bringing an action against the directors on the ground that the prospectus was false and misleading.

The Solicitor (Mr. Tatham) decided that the motion was out of order, as no notice had been given of any such resolution.

Mr. Dunsmuir thought the company from the first was a mistake, and that it was a fraud on the part of the vendors.

Mr. Ems asked whether it was intended that the directors would take the amount charged in the balance-sheet for their remuneration.

The Chairman said he stated at the last meeting that the directors would not take any fees until the company was in a different position. They had not taken a penny.

The Solicitor said a point requiring consideration was the question of appealing in the case against Mr. Hoare, a course they were strongly advised by counsel to follow. There were reports which came over on the eve of the trial which for reasons of evidence they could not use, and which were of great importance. He urged the appointment of the committee as suggested by the chairman, remarking that if they came to the conclusion that they ought to proceed against the directors, the latter would retire and give the shareholders every opportunity of doing so.

Mr. Gribbon thought that was a very fair suggestion, and he proposed: "That a committee consisting of Mr. Burton, Mr. Ems and Mr. Dunsmuir be appointed to confer with the directors, investigate the affairs of the company and advise the shareholders as to what course should be adopted; further, that this meeting be adjourned to February 24th, at the same time and place."

Mr. Seymour seconded the motion. He was not, he said, acquainted with any of the directors, but he thought that some of the remarks that had been made were a little hard on them. He was present during the trial in the case against Mr. Hoare, and heard the judge say most emphatically that the directors had acted most honorably throughout. The directors had lost their own money and received no remuneration whatever; and he thought that, so far from incurring any hostile feeling, they were deserving of the sympathy of the shareholders. (Hear, hear).

Mr. Gribbon's motion was then put and agreed to, the consideration of the report and accounts being postponed until the adjourned meeting, after the motion for their adoption had been negatived.

The proceedings closed with a vote of thanks to the chairman, on the motion of Mr. Burton.

An extraordinary general meeting of White's Asbestos Company, (Limited), was held on the 15th ult., at Winchester House, London, Mr. J. H. Hamilton presiding, for the purpose of considering the following resolution: "That the Company be wound up voluntarily under the provisions of the Companies Acts, 1862-90, and that a liquidator or liquidators be appointed for the purposes of such winding up."

The Chairman remarked that at a meeting held a fortnight previously, a committee was appointed to investigate and confer with the directors. That committee met on Saturday last; but in the meantime, some of the shareholders had taken action against the company, and the directors were advised that it was absolutely necessary, in the interests of the general body of the shareholders, that the concern should be put in liquidation.

Mr. Dunsmuir contended that the meeting had been hastily called, and that the directors should have waited until the committee of investigation had reported.

Mr. Milton urged that the report of the committee ought to be presented before any action was taken.

The Solicitor of the company (Mr. Tatham), pointed out that the passing of the resolution to wind up would not relieve the directors of any responsibility which might attach to them. If the shareholders declined to agree to the resolution, the result would only be a large waste of money in law courts, and that would be a very sad thing for the general body of the shareholders.

The resolution for winding up was carried *nem. con.*, and Messrs. Ems and Borradaile (the Secretary), were appointed joint liquidators.

LEGAL.

White's Asbestos Company (Limited), v. Hoare.

This case was tried in London, Eng., in December, before Mr. Justice Day, without a jury, Mr. Finlay, Q.C. and Mr. J. Walton appearing for the company, and Mr. Reid, Q.C., and Mr. Hadley for the defendant. The action was for calls, with a counter-claim to have the contract rescinded on the ground of misrepresentation in the prospectus.

Mr. Finlay, in opening the case, said the suit was to recover £790, being the allotment money and first call of 5s. per share on 1,250 shares, and interest. The defendant had formally traversed the allotment and brought forward a counter-claim, asking to have the contract to take shares rescinded on the ground that some of the statements in the prospectus were not true.

The allotment was admitted by defendant's counsel, and Mr. William Borradaile, the secretary of the company, was put upon the stand.

Mr. Reid proceeded to cross-examine, reading some of the passages in the prospectus relied on, such as the statement that the properties in question had been specially selected and proved, being situated in the Province of Quebec; that according to the report of Mr. Boyd, the asbestos was of the finest crystalline fibre, and peculiarly free from impurities; that the average produce from mines in the immediate neighbourhood was over 350 tons per annum, and that an average of at least 350 tons might be expected from each of the four properties referred to, yielding a profit of fully £12,000. The witness, in answer to questions, said the company was started in 1889. It had not produced much asbestos yet; two or three tons had been sold, but it was inferior stuff, and only fetched about £8 per ton. Altogether about £20 had been realized, and it cost more than that to bring it over. There were indications of there being a good deal to sell, but the property was not yet developed, and they had now shut down for the winter. He was still hopeful. They were not now selling shares; they did not require to, having sufficient capital. About £15,000 had been subscribed and it had not yet been all spent. Some discussion here ensued as to the legal effect of reports embodied in a prospectus which might not turn out to be accurate on a claim to rescind a contract to take shares. No distinct ruling having been given, the cross-examination was continued: In July, 1889, there was a report by Mr. Donald, which was a good report. In November, 1889, there was one by Mr. Obalski which was not encouraging.

The report of the evidence of Mr. Boyd was then read, upon which Mr. Justice Day commented severely, saying that a more incompetent person to make a report could hardly have been found.

Mr. Hoare, the defendant, was then called, and said he had applied for shares on the faith of the prospectus. He noticed that Mr. Boyd was the engineer of the company.

Cross-examined: He applied on April 15, and received the allotment letter a day or two afterwards. He got a notice of call, dated May 8, on August 28. He received a letter demanding payment. He was living in London then. He returned no answer, and on October 16 his solicitors wrote repudiating the liability, and referring to comments which had been made in an evening paper on April 15 and 18, on the company, and the reply that had been made thereto on behalf of the company. Previous to October 16, he had taken no steps beyond placing the matter in the hands of his solicitors, which he believed was early in May.

Regarding the articles in question, the learned judge said their publication put a different complexion upon the matter because it now appeared that the attention of the directors had been called to the matter before the shares were issued.

Mr. Gadsden, defendant's solicitor, said he had made enquiries from persons knowing the asbestos business and obtained information in June, but not sufficient to enable action to be taken.

Mr. Finlay then addressed the court on behalf of the plaintiff company, going into details of the history of the company, (which will be found reviewed at length in the summing up of the judge). He then stated that he should call the directors, and their evidence would prove the *bona fides* of the undertaking. They did not profess to have any personal knowledge of the matter, and fairly stated the materials upon which they invited subscriptions. Lastly, he submitted that the defendant's delay was fatal to the rescission of the contract.

Mr. Percival Fowler, who was next called, said he was a mining engineer, F. G. S., etc. He had known Mr. Boyd since 1877, and had many opportunities of judging of his ability and capacity. His judgment could be relied upon as far as was possible in mining matters. He saw him in the latter part of 1888, when he introduced Mr. White, and witness introduced them to the gentlemen who became directors, and was present at all the interviews before the prospectus was issued. Witness undertook the principal business of promoting the company in consequence of Mr. White falling ill and having to leave London. Mr. Boyd produced his report and also the report of Dr. Ells to the Government of Canada on the natural history and geology of the province, which dealt at some length with asbestos. The directors had carefully considered both reports and had investigated the matter thoroughly. The word "prove" in mining affairs had a technical meaning, viz.: that the existence of the mineral had been actually proved by sight, and if necessary by analysis.

Cross-examined: He had never heard of this enterprise until Mr. Boyd called on him. He, with Mr. Boyd and Mr. White, were at the bottom of the affair. Mr. Welch was White's man. White found the money to buy the property; he did not know the exact cost. It was White's property, and Welch had a large interest in it.

A schedule was here produced which set out the original purchase price of the property as $2,725 or a little over £500.

Further cross-examination elicited that a good deal of money had been spent on the property, a large staff of men having been engaged in prospecting over a considerable area, resulting in the properties in question being selected. By his agreement with White of April 10, he was to have about £15,000 cash and shares for promoting the company—for buying a property which had cost about £500. He had not been concerned with Boyd in any other company. Boyd told the directors he had done a good deal of work on the property. The directors asked Mr. Boyd how he arrived at the calculation of 350 tons of asbestos per annum for each of the four properties, and he told them, as stated in his examination, that he calculated that 7,000 tons of rock might be broken, and that there might be 5 per cent. of asbestos in it. He had taken the average of all the figures given in Dr. Ells' report to construct his table. Witness' remuneration was to come out of the vendor's share. His expenses amounted in all to about £4,000. He arranged with the directors that he would take no cash beyond what was actually expended; £1,500 was paid to Mr. White, and out of the £15,000 raised, that left about £9,000 for working expenses, and as the directors thought £10,000 would be required he gave an undertaking to subscribe for 1,000 shares. Mr. White was now dead. He, a Mr. Waite, who did their brokerage, and Mr. White subscribed for about 4,000 shares, and paid up the calls on them. White took 2,100 shares, and he and Waite 700 a-piece. Mr. White was to get £6,000 in cash and £39,000 in shares. Witness was about £200 out of pocket, but he had the shares.

Mr. Hamilton said he was chairman of the company from the first. Being satisfied of the *bona fides* he agreed to join. He only took about 200 shares; most of the other directors took more, and all paid for them with their own money. He exercised his best judgment on the prospectus. He attached no importance to the price paid for the property originally. He was aware of all the circumstances regarding Mr. Fowler's and Mr. White's connection with the company. The company was registered on April 9, and the prospectus was issued on the 13th. There were several editions of it; they were prepared by the directors with the aid of the solicitors and Mr. Fowler. The prospectus said: "These are valuable asbestos properties, which have been specially selected and proved;" and the word "proved" was used advisedly. The question was asked, Was it proved? and Mr. Fowler advised them that it was the proper word to use. They believed Mr. Boyd's statements to be true; they knew his estimate of 350 tons from one property was not based upon arithmetical data. After three or four months he was much disappointed; but he had never seriously entertained the idea of winding up. He believed still the properties could be made to pay, but he did not think they were as valuable as he did at first. He did not know whether work would begin again; it would depend upon the shareholders. The refusal of the defendant and others to pay their calls made a great difference to the company's success.

Two mining engineers were then called, who gave testimony as to the meaning of the word "proved."

Mr. Fowler was then recalled, and gave particulars of his receipts and expenses, the result of which was to show a surplus in his favor of £622 17s. 2d.; but he was liable for further calls to the amount of about £1,200 when called upon by the directors.

The case was then adjourned for two days.

On its next hearing, Mr. Reid asked his Lordship to conclude that the report by Mr. Boyd was a thoroughly dishonest report. If there was anything untrue in the prospectus which was material, whether the directors knew of it or not, Mr. Hoare would be entitled to have the contract rescinded.

Mr. Finlay: For the purpose of rescission, if there is any material mis-statement of fact by which the plaintiff was induced to apply, if he comes with promptitude he is entitled to rescind.

Mr. Justice Day: Then the only question will be promptitude here?

Mr. Finlay: What I said did not cover what Boyd said. The prospectus stated frankly that it was the report of Mr. Boyd.

Mr. Reid submitted that the prospectus contained a material mis-statement when it set forth that the property was "a proved asbestos property." Then if the directors did not actually adopt Mr. Boyd's report, at any rate it was put forward as containing statements as to which they had made reasonable enquiries, and had reasonable grounds for believing them to be true. He contended that his client had not come too late to entitle him to the relief asked for.

Mr. Finlay pointed out that it had by no means been shown that the property did not contain asbestos in appreciable quantities, which might be won at a profit if properly worked. Later reports agreed that lot 9 was valuable. With regard to the prospectus, he submitted that if a company, in issuing a prospectus, quoted from the report of an expert, and stated honestly the circumstances under which he had been employed, they were under no liability whatever. He also submitted that the defendant had come too late to enable him to succeed.

Mr. Justice Day remarked that no imputation rested upon the personal honor of the directors.

The leared judge, in giving judgment, said the first question was whether the defendant had shown any good ground for rescinding the contract; and secondly, if he had shown good grounds, whether he had deprived himself of his opportunity for taking advantage of them by reason of his own laches and neglect. The history of this company was very short. In January, 1889, a person named Welch had nominally bought this property, which was subsequently sold to the company for a sum of £500. The property was situate in Quebec. It was not altogether wild forest land; it was land which had been explored, and, in a certain sense, tested for asbestos. Some persons had undoubtedly dug some pits upon the land in a few places, and had apparently worked it for the purpose of raising asbestos. Asbestos was a mineral which, no doubt, was found in the neighbourhood, and had, no doubt, in some places, been profitably mined. It had not, so far as he could ascertain, been profitably mined upon any portion of the property in question. It was sold in January, 1889, to Welch or White, it was difficult to say which, for £500. Welch seemed to have stayed in Canada, and one did not see exactly what interest he took in the matter. But White came over to England in the early part of 1889, and said he was an agent of Welch, and he brought with him a report by a person named Boyd. Boyd had given his evidence on commission, and had disclosed what amount of fitness or competence he could have had to enable him to discharge the duty of reporting upon the properties. There was a good deal in the cross-examination to show from his own statements that he was a man who had no knowledge and no qualifications which fitted him, as far as one could judge, for reporting upon any such mineral property. He appeared at one period to have seen some geological specimens, amongst them being a specimen of asbestos. He, as a mechanical engineer, was proficient in workshops, and had been spoken of by Mr. Fowler, who seemed to have been the only person who was consulted as to his fitness. Mr. Fowler expressed an almost unbounded confidence in his fitness, but he (Mr. Justice Day), could not exclude from his consideration that Boyd and Fowler were both very much interested in this concern, because White seemed to have made an arrangement with Fowler, whereby the latter was to receive a large sum in shares and money to become the promoter of the company. So Boyd was presented to the company, vouched for by Fowler, who was the promoter, and not improbably, he would not say more, was interested in the scheme from its commencement, a circumstance which in his (the learned judge's) opinion very considerably diluted the importance one might be disposed to attach to the recommendation given by Mr. Fowler to Mr. Boyd. He was very happy to say no imputation attached to the directors, who appeared to have been honest believers in the report of Boyd. They put money into the company and had not taken any out of it. They seemed to have acted with the utmost fairness, and were deluded into taking shares in the company of which they became directors. But, although their honesty and honor were not disputed, one could not but see that they just seemed to be the class of men who existed for the purpose of being made use of by people who had schemes of that sort to bring out. They had got money, they were men of honorable character, and they were credulous to a degree which almost passed the limits of carelessness. The property had been bought for £500 in January, and in the April following, it was sold at the somewhat increased rate of £45,000. The value of the property, in its passage across the Atlantic, had developed from £500 to £45,000, These honorable but very unwise and dangerous gentlemen were, with the qualifications they had, capable of doing a great deal of mischief. Such persons were constantly doing a great deal of mischief by lending themselves carelessly and foolishly to the plans of persons much more wily and skilful, and who knew much better what they were about than they did. The directors brought out the company with a working capital of £15,000 under the guidance of Mr. Boyd. They proceeded to work, and have worked, up to the present time, more or less, except when they had shut down for the winter, which, according to some reports, was not necessary, as the winter was the best time for working asbestos. They appeared to have produced somewhere about three tons of what was described by the secretary as inferior stuff, which was sold here at a considerable loss. That was the result of the working. The defendant said the prospectus was untrue. He found that it undoubtedly was untrue. The reports made by Mr. Boyd, set out in the prospectus were untrue reports—utterly untrue. That was made perfectly clear, not merely by the test of workings, but by the reports which had been put in evidence obtained by the directors themselves. It was quite clear from the three reports, that, as regards the majority of the lots, Boyd's report was untrue. He (Mr. Justice Day), did not for a moment consider that the company was not responsible for the untruthfulness of the report, if it was inserted as part of the prospectus. The duty of the company was perfectly clear, not to put forward any report that could not reasonably be trusted. Boyd possessed no qualifications for making such a report, and the directors foolishly trusted him. They seemed to have been utterly infatuated about Boyd. The directors saw the newspaper article the same or the next day that it appeared. It pointed out precisely what the real defects in the prospectus were, and was evidently written by a man who knew something about asbestos. It was, at any rate, a caution to the directors who knew of the existence of the publication, not to proceed to allotment. But what did they do? They telegraphed for Boyd to come over from Dublin. He came over and saw them; he satisfied them — easy-going people—and they proceeded to allot the shares to the public in the face of those statements. Such carelessness was really startling. One would have thought they might have been put on their guard. In the witness-box the directors who were called said the fact that the property was bought for £500 did not affect their judgment, as sometimes a valuable property might be picked up cheap. He found that the directors, in putting the prospectus in the way they did, represented by implication Boyd to be a man reasonably qualified to report on such a subject. In his judgment they issued the report as being a trustworthy report, and they had no reason whatever to believe it was. But, quite apart from the report of Boyd, there were statements by those who settled the prospectus, and for whom the company were, no doubt, responsible; such as that which said that the properties were specially selected and proved for asbestos. Whatever meaning one attached to the word "proved," it was untrue in this case. "Proved" must be taken to mean there was evidence sufficient to satisfy any reasonable person having an understanding on the subject, that there was mineral in workable quantities in the commercial sense. In his judgment the statement that the property had been proved was untrue. He was satisfied there had been material untrue statements, for which the company was responsible. The only question left was as to the delay, and that he decided in favor of the defendant. He gave judgment, therefore, for the defendant, with costs.

Supreme Court. Appeal: Hardman & Taylor v. Putnam. A New Trial Ordered.

This appeal was from the judgment of the Supreme Court of Nova Scotia, sitting *in banco*, dismissing the defendant's motion for a new trial and appeal. The action was brought for the winding up of an alleged co-partnership between the appellants and respondents. The co-partnership related to certain gold mines and gold mining areas situate at Oldham, in the County of Halifax. The trial was before Mr. Justice Weatherbe with a jury. The main issue was whether the plaintiff, C. Putnam, had lost his rights in the co-partnership by reason of his having failed to contribute capital as agreed, and as required by the exigencies of the undertaking. This issue involved a consideration as to the terms of the agreement between the parties, which admittedly had never been reduced to writing and executed; the defendants setting up a provision that the plaintiff was to furnish a certain amount of capital for the enterprise, also a stipulation providing for forfeiture of the plaintiff's interest in the event of his failing to furnish such capital within a limited time. The plaintiff denied that any such terms had been agreed upon. Mr. Justice Weatherbe submitted a number of questions to the jury, and charged in favor of Putnam with regard to each. The jury accordingly found upon all these issues for the plaintiff.

In the present appeal Hardman & Taylor claimed that the judgment of the lower court was wrong because:—

(1) Mr. Justice Weatherbe improperly charged him with fraud, not raised by the pleadings, and submitted issues of such fraud with a direction not admitting of doubt that in the judge's opinion the jury should find these issues against the defendants.

(2) The findings should be set aside for misdirection.

(3) Evidence for defendants was improperly rejected.

(4) The findings were against the weight of evidence.

(5) The question of Hardman's interest in the partnership property was improperly left undetermined.

The appeal was heard at Ottawa before a full bench on the 18th instant. Court were of opinion that there was misdirection in the charge of the judge for having introduced numerous discrepancies not bearing upon the real issues in the case, which was whether there was a partnership as alleged by plaintiff, or whether it was a partnership subject to forfeiture as alleged by defendants, and therefore a new trial was ordered. They were also of opinion that the case would be more advantageously retried by a judge without a jury than with a jury, it being purely an equity case. Hardman was completely exonerated from the charges of fraud. Severe strictures were made on Judge Weatherbe's finding.

General Phosphate Corporation v. Macintosh.

This case came up for trial before Mr. Justice Malhiot in Hull, on January 26th; Mr. C. J. Brooke for the plaintiffs, and Mr. T. P. Foran for the defendant. This action arose out of the removal by the defendant of certain plant, consisting of derrick irons and an anvil from the Ross Mountain property, in which he, together with the Hon. C. C. Colby and Hon. J. J. C. Abbott, had held an interest, having sold out to the plaintiffs. It was claimed by the latter that the above tools had been sold with the property, this belief arising out of certain memoranda of the terms of sale in their possession, in which these were included. The defendant denied this, and proved that the land alone had been transferred. Several witnesses were called to prove the ownership of the articles, and the case was taken *en delibere*. Judgment was given on January 30th, Mr. Justice Malhiot giving the verdict in favor of the defendant, with costs, but remarking at the same time that notice should have been given of the intention to remove the tools.

Macintosh v. Stewart.

Action has been taken by Mr. W. MacIntosh, of Buckingham, Que., against Mr. G. Stewart, mining contractor for the General Phosphate Corporation, for $6,000 for salary and breach of contract. The plaintiff alleges that he had a contract with defendant to act as manager under the latter, and that the agreement was not carried out. The case will be argued at the next assizes. Mr. M. O'Gara has been retained by the plaintiff, and Mr. J. S. Fisher by the defendant.

The Springhill Explosion.

[By Telegraph to the Review.]

Springhill, N.S., February 23.—An explosion unparalleled in the annals of Canadian mining, occurred here at 1 p.m. on Saturday last, in the east slope of the Cumberland Railway and Coal Co's. colliery. Although the company was formed only eight years ago, their operations are carried on upon a very large scale, the output being the largest in the Dominion. The area held by the company covers ten square miles leased from the Nova Scotian Government; connection with the Intercolonial railway is made by a branch line a few miles in length. Fully 1,100 men are employed in the three slopes comprising the colliery, which are independent of each other, with the exception that No. 1 and 2 slopes are connected by a tunnel for the purposes of working and ventilation. Coal is hoisted from all three. The explosion occurred in No. 6 and 7 balances, connecting the 1,900 foot level with the 1,300 foot level in No. 1 slope. The balances are about 450 feet in length; three bords were being driven to the westward from 100 to 150 feet in No. 6 balance, and two to the eastward. There were also six bords on No 7 balance about 400 feet further to the westward. The precise point of the disaster is not definitely known, but it is conjectured to have been in No. 3 bord, in No. 7 balance, as shot-firer Wilson was found in this bord, and there is every indication that a shot had just been fired, as a large quantity of coal was loosened. Out of forty men employed on these balances, not one is left to tell the tale. From the point where No. 7 balance connected with the 1,300 foot level—which is familiarly known as the stoney level—it extends about a quarter of a mile on the same seam; the coal from the stoney level is taken through into No. 2 slope and hoisted. A large number of men employed in the workings inside of No. 7 balance on the stoney level were overcome with choke-damp immediately after the explosion. The bodies were recovered through No. 2 slope. A list of the dead has been made out, and it is stated that at least one hundred and twenty-two persons lost their lives; of this number 54 were married, 40 single, and 25 were boys. They leave behind 54 widows, 161 orphans and five widowed mothers, with families deprived of all means of support. After the explosion about 20 wounded were taken out of the pits; some were seriously burned and others unconscious from the effects of after-damp. All will recover except two who died from the effects of their injuries. Doctors from Amherst, Parrsboro' and Oxford were promptly on the spot, and everything possible was done for the alleviation of the sufferers. They were covered with blankets and at once conveyed to their homes in sleighs. The scenes witnessed at the pit's mouth beggared description. A rope had to be stretched across the bank-head to prevent the widows and the children from drawing too near. The searching parties at once began to go down, but before long some of the bravest of the many volunteers had to be carried out overcome by damp. Many incidents of heroic bravery are recounted. About ten bodies were taken out on Saturday, principally through No. 2 slope. In No. 1 slope the levels and working places were so obstructed by timbers and debris that little progress towards the recovery of the bodies could be made, and the work had to be abandoned at six o'clock until the ventilation was restored. This was rendered difficult owing to stoppings being blown out. Steps were then taken to clean the levels and get full circulation of air: two downcast fans, capable of producing about 78,000 cubic feet of air per minute, were run at a high rate of speed, and after arranging ventilation by brattices, the exploring parties again entered the mine at eleven o'clock on Saturday night. From that time work has been steadily pushed forward and about one hundred and six bodies have been taken out. The corpses when taken out are placed in rows in the carpenter shop, washed and then removed to their homes and boarding houses. As many as twenty bodies have been lying in the improvised morgue at one time, and the weeping of wives, mothers and children looking for their dead is heartrending. Very few of the dead were mutilated to any extent; about ten bodies were recognized by the clothing, bodily marks or otherwise, owing to the the features being obliterated; their faces were a hlackened, charred mass. One body was badly torn by the explosion, and had to be taken out in a bag and lashed to a board; it was then placed in a square box for interment. Two bodies are now lying unclaimed because unrecognizable. Twelve funerals took place Monday afternoon. In one family, that of Reid Carter, the father and two sons were killed. Fred. Carmichael, who was injured a short time ago by an accident in the mine, loses three sons, and another was severely burned. Jesse Armishaw loses three sons; in other families two are missing. Two sons of Hugh Bunt are dead, and two little boys, sons of Robt. McVey, were found together. Various theories are advanced as to the cause of the explosion. It was claimed by many that it was caused by a blown-out shot, but this theory has been exploded by an examination of the place by the Inspector of Mines, Mr. E. Gilpin, and other officials. The truth will probably not be known until the level in No. 1 slope is cleared into the fall. There are several falls on this level, and it is supposed that a number of the missing are covered by the debris. Manager Swift is among the number; his body has not yet been recovered. There are about fourteen bodies still missing. On Wednesday last the working places in No. 1 slope were examined by a committee appointed by the workmen to report upon the safety of the mine. Their report was in every way satisfactory, and it is also confirmed by the report of Mr. Wm. Madden, the Deputy Inspector of Mines, who carefully examined the pits on the day previous to the explosion, and reported the mine in good condition. Mr. Madden tested the air at the head of both balances and on the stoney level found from 1 to 1.50 per cent. of fire-damp. Underground Manager Conway was in the balances Saturday morning, but left the pit at half past ten and was relieved by Manager Swift. Mr. Conway says the mine was in the best of condition and that the night examiners reported to him that there was no gas. That particular part of the mine was very dry and dusty and this has given rise to the conjecture that perhaps the combustion of coal dust and gas produced carbonic monoxide, a more deadly narcotic poison than after-damp, and that perhaps, the large number of deaths is partly attributable to this cause. The greatest precautions were taken to prevent any explosion of coal dust and gas, and the bords were fitted with a complete system of water works and hose to lay dust. The working places in both balances had been watered Friday, and two shiftmen, who are among the killed, were sent into No. 6 balance on Saturday, for the purpose of sprinkling the bords. A great many bodies were recovered during Sunday, and others have been brought out to-day. It is expected that all will be out by Wednesday at the latest. Operations at the colliery will be resumed at the end of the week. No. 3 slope is not connected with the others and is all right. No. 2 slope is now clear, and the east side of No. 1 slope is also in good condition. The force of the explosion was greatest in Nos. 6 and 7 balances, where it will probably take a fortnight to put things in repair again. The damage to other parts of the mine is slight except in the levels, on which there are a number of falls of stone which will have to be cleaned up. The explosion confined itself to that section of the pit entirely, and might be termed local. Men working in the east side of the pit were not aware that anything unusual had happened until an alarm was sounded, when they made their escape. Probably five hundred persons were underground in all these slopes at the time of the explosion. Safety lamps were being generally introduced, but naked lights were used in No. 6 balance. This afternoon a most deplorable accident occurred. The body of a boy named Dupee was brought out of the pit and his mother and a little brother were standing on an elevated platform waiting to identify the remains, when the little boy fell, striking his head, and was instantly killed; his skull was fractured. Both bodies were taken home together. Cases of extreme destitution are cropping up, and financial aid is urgently needed. To-day subscriptions amounting to $3,500 have been received, but $70,000 at least is required at once. Last night a little child, one of a fatherless family of eight, was found crying for bread on the street, and many similar cases could be cited. An appeal has been made by the mayor on behalf of the 56 widows and 161 orphans. The inquest begins this evening before Dr. C. A. Black, of Amherst, coroner. It is the intention to have the jury at once retire and review the remains of John Connorton, who was killed by fire damp, and, if possible, for at least a part of the jury to go down the pit and examine the scene of the disaster. The jury empannelled is as follows: Wm. Hall, foreman, A. E. Fraser, Daniel Ferguson, Simon Fraser, Geo. Watt, Robt. Gray, Daniel Codhill, Chas. Simpson, R. W. McDonald, Richard Bennett, Timothy Leadbetter and Robert Scott.

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Annotated List of Canadian Minerals.[*]

G. C. HOFFMAN, F. INST. CHEM., ETC.

(Continued from Page 14.)

251. SULPHUR, NATIVE,—Has been met with in the form of shattered crystals, in a gypsum quarry in Colchester County, Province of Nova Scotia. It occurs as a deposit from sulphurous springs in several localities in the Province of Ontario, as at Charlotteville (Norfolk Co.), and in Clinton (Huron Co.), at which latter place there is a deposit affording masses of pure yellow compact, or fine-grained, sulphur, together with small transparent crystals of the same. Has also been found, in association with sal-ammoniac, as a deposit on cliffs of shale on Smoky River, North-west Territory. Anal., G. C. Hoffmann, Rep. Geol. Can., 1875-76, p. 420.

252. SYLVANITE—Occurs in association with argentite and more or less galenite and chalcopyrite, in a gangue of white sub-translucent quartz at the Huronian mine, Township of Moss, District of Thunder Bay, Province of Ontario.

253. TACHYLITE—Occurs according to Dr. G. M. Dawson (Rep. Geol. Can., 1876-77, p. 84), as masses in agglomerate, near the entrance of Peninsula Bay, Fraser Lake, Province of British Columbia.

254. TALC—Talc in crystalline foliated masses is sometimes met with in Canada, but it more frequently forms beds of a compact or schistose variety of steatite or soapstone, interstratified with serpentine, magnesite, or clay-slate, and often enclosing actinolite, or bitter-spar. These beds, which occur in strata of Pre-Cambrian or Cambrian age, and are often of considerable thickness and extent, lie principally in the Townships of Bolton, Sutton and Potton (Brome Co.), in the Province of Quebec. An unctuous foliated rock, consisting of talc with intermixed carbonates of lime and magnesia, and small quantities of quartz and magnetite, is found in the Laurentian of the Township of Elzevir (Hastings Co.), in the Province of Ontario. Analyses, T. S. Hunt, Geol. Can., 1863, p. 469.

255. TENNANTITE—Occurs in association with chalcopyrite, pyrite, quartz, etc., at the Crown mine, Capelton, Sherbrooke County, Province of Quebec. Anal. B. J. Harrington, Trans. Roy. Soc., vol. i, sec. iii, p. 80, 1882-83.

256. TETRAHEDRITE—Ordinary tetrahedrite (containing only a little silver) occurs, in a gangue of ankrite, in the vicinity of Foster's Bar, about twenty-five miles above Lytton, Fraser River, and a more or less argentiferous tetrahedrite, associated with variable amounts of galenite and small quantities of one or more, or all, of the following minerals, viz., pyrite, chalcopyrite, bornite, sphalerite is found at the Illecillewaet mines, between the north and south branches of the Illecillewaet River, Selkirk Range, and at the International claim on the west side of Kootanie Lake; on Otter-tail Creek and Carbonate Creek; at Cherry Creek, thirty-three miles east of the head of Okanagan Lake: at some of the Stump Lake mines, Nicola Valley; on Jameson Creek, which flows into the North Thompson River, and elsewhere in the Province of British Columbia.

257. THOMSONITE—Specimens of this mineral, in the form of radiating crystals, have been found at the North Mountains, of King's County, Province of Nova Scotia. See also note to "Mesole."

258. TITANITE—Occurs in minute amber-colored grains and crystals, in the granitoid trachytes of Brome (Brome Co.), Shefford (Shefford Co.), and Yamaska (Yamaska Co.), Mountains, and in the diorite of Mount Johnson (Iberville Co.)—in crystals, often of considerable size, of a clove-brown or chocolate-brown color, in the Laurentian of the Townships of Argenteuil and Grenville (Argenteuil Co.), Buckingham, Templeton, Wakefield and Hull (Ottawa Co.), and at the Calumet Falls in Litchfield (Pontiac Co.), in the Province of Quebec. It is also met with in the Laurentian of the Townships of Sebastopol—where very large crystals are sometimes found, also fine twin crystals, and a massive form—(Renfrew Co.), North Burgess—of a honey-yellow color—and North Elmsley (Lanark Co.), and other Townships in this part of the Province of Ontario. Analyses, T. S. Hunt, Geol. Can., 1863, 503, and B. J. Harrington, Rep. Geol. Can., 1877-78, p. 28 G.

259. TOURMALINE—Principally black, but not unfrequently brown—is of comparatively common occurrence, in many places, in rocks of the Laurentian series. Among the numerous localities of its occurrence may be mentioned:—Near Hunterstown—where a single transparent brown crystal, remarkable for its modifications, was obtained—(Maskinongé Co.): at Calumet Falls in the the Township of Litchfield, fine translucent, rich yellowish-brown colored, highly modified crystals with brilliant faces—(Pontiac Co.); in the Township of Clarendon—brown crystals of great beauty—(Pontiac Co.): in the Townships of Grenville and Argenteuil—black crystals—(Argenteuil Co.): also black crystals on the west side of the North River at Jérôme (Terrebonne Co.)—in the Province of Quebec. In the Province of Ontario:—the Townships of North Elmsley, North Burgess, and Bathurst (Lanark Co.), Ross—where crystals almost equal in beauty to those from the Calumet Falls have been found,—and Blythfield (Renfrew Co), Galway and Stoney Lake in Dummer (Peterborough Co.), and Charleston Lake in Leeds County.

260. TRAVERTINE—Deposits from calcareous springs—the material of which is in some instances hard and solid, at other times porous and tufaceous—are abundant in many parts of western Ontario, being met with in the counties of York, Wentworth, Oxford, Wellington, Grey, Simcoe, etc.

261. TREMOLITE—Is abundant in the Laurentian limestones at the Calumet Falls in Litchfield (Pontiac Co.), Province of Quebec; also in the Townships of Blythfie (Renfrew Co.), and Dalhousie (Lanark Co.), and short, thick and highly modified prisms of a white transparent tremolite, have been observed by Prof. Chapman in a white crystalline limestone in the Township of Algona (Renfrew Co.), Province of Ontario.

262. TURGITE—Occurs with brown hematite at Tenny Cape (Hants Co.), Province of Nova Scotia. Anal., H. How, Phil. Mag., 4 ser., vol. xxxvii, page 268, 1869.

263. UXELITE—Occurs with cryptomorphite, Howlite, mirabilite, halite, Arragonite and selenite in the gypsum deposits of Hants County—as at Clifton quarry, Windsor; Brookville; Trecothick's quarry; Three Mile Plains; Winkworth; Newport Station—Province of Nova Scotia. Anal., H. How, Phil. Mag., 4 ser., vol. xxxv, p. 32, 1868.

264. URACONITE—Was observed by Dr. Hunt, in the form of a sulphur-yellow crystalline crust, lining fissures in magnetite in the Township of Madoc (Hastings Co.), and by Prof. Chapman in a deposit of magnetite in the Township of Snowdon (Peterborough Co.), Province of Ontario.

265. URALITE—Good specimens showing the partial and complete alteration of pyroxene to uralite, have been found in the Township of Templeton (Ottawa Co.), Province of Quebec. Anal. B. J. Harrington, Rep. Geol. Can., 1877-78, p. 20 G et seq.

266. URANINITE—Has been found at the Villeneuve mica mine, in the Township of Villeneuve (Ottawa Co.), Province of Quebec. Ann. Rep. Geol. Can., vol. ii, p. 10 T., 1886.

267. VALENTINITE—Is found with native antimony, stibnite, senarmontite and kermesite, in veins in argillite, in the Township of South Ham (Wolfe Co.), Province of Quebec.

268. VESUVIANITE—Occurs in yellow crystals, with garnet, pyroxene and zircon, in calcite, in the Township of Grenville, and in large brown crystals, with tourmaline, at the Calumet Falls in Litchfield (Pontiac Co.): in large brownish-red crystals in a quartzose rock, in the Township of Templeton (Ottawa Co.), and Dr. Harrington has recorded the finding of small prisms of green idocrase imbedded in cinnamon stone, in the Township of Wakefield, in the same county—Province of Quebec.

269. VIVIANITE—An earthy form of this mineral, of a bright blue colour, occurs underlying a bed of bog iron-ore in Côte St. Charles, Vaudreuil (Vaudreuil Co.), in the Province of Quebec. It has also been met with, in a similar form, at the "Ramparts," Porcupine River, Yukon District, North-West Territory.

280. WAD—This variety of bog-manganese has been met with in Bolton (Brome Co.), Stanstead (Stanstead Co.), Tring, Aubert-Gallion and Ste. Marie (Beauce Co.), and several other localities in the Province of Quebec. At Parrsborough (Cumberland Co.), and in Halifax County: at the head of Lewis Bay (Cape Breton Co.), and in association with the iron ore of the Martin Brook mines at Londonderry (Colchester Co.), Province of Nova Scotia. Anal., H. Louis, Trans. N.S. Inst., vol. iv, p. 427, 1878.

271. WERNERITE—Scapolite is very frequently met with in the Laurentian: it occurs in large crystals and cleavable masses, with pyroxene and sphene, in Hunterstown (Maskinongé Co.); in the Townships of Grenville—in the Augmentation of, pale lemon-yellow—(Argenteuil Co.), Templeton—where good, and occasionally very large, though less perfect crystals are met with—Portland and Wakefield, etc. (Ottawa Co.), and Calumet Island—lilac-colored—(Pontiac Co.), Province of Quebec. In very large, but imperfect crystals, on Turner's Island in Lake Clear, in the Township of Sebastopol, at Golden Lake in the adjoining Township of Algona (Renfrew Co.), and in good crystals in the Township of Ross, in the same county—Province of Ontario. Anal., T. S. Hunt. Geol. Can., 1863, p. 474, and F. D. Adams (showing presence of chlorine in scapolites), Rep. Geol. Can., 1877-78, p. 32 G.

272. WILSONITE—Fine specimens of this mineral are found in the Townships of Portland, Templeton and

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[*] Paper read before the Royal Society of Canada.

Hull (Ottawa Co.), in the Province of Quebec. As there met with, it is most frequently intimately associated with scapolite, the two minerals occasionally blending into each other. It also occurs in the townships of Bathurst—the locality of its first discovery by Dr. Wilson—and North Burgess (Lanark Co.), in the Province of Ontario

273. WINKWORTHITE—The name proposed by Prof. How for a mineral found by him, in gypsum at Winkworth (Hants Co.), Province of Nova Scotia. Anal., H. How, Phil. Mag., 4 ser., vol. xli, p. 270, 1871. [Assumed to require further investigation.]

274. WITHERITE—Occurs in a silver-bearing vein—the veinstone of which consists of calcite and quartz with some fluorite, carrying argentite and native silver—at Twin Cities mine, near Rabbit Mountain, Thunder Bay, Lake Superior, Province of Ontario.

275. WOLFRAMITE—Was found by Prof. Chapman, in a large boulder of gneiss, on the North shore of Chief's Island, in Lake Couchiching, Province of Ontario. Anal., T. S. Hunt, Geol. Can., 1863, p. 503.

276. WOLLASTONITE—Fibrous wollastonite is often found in the limestones of the Laurentian series, associated with pyroxene, felspar, quartz, mica and other minerals. Some of the best known localities of its occurrence are: St. Jérôme and Morin (Terrebonne Co.), and the Township of Grenville (Argenteuil Co.), in the Province of Quebec—and the Townships of North Burgess (Lanark Co.), and Bastard (Leeds Co.), in the Province of Ontario. Anal., Mr. Bunce, Geol. Can., 1863, p. 465.

275. ZIRCON—Small brownish crystals of zircon, with tourmaline, are found in granitic veins which traverse gneiss on the North River, in St. Jérôme (Terrebonne Co.); reddish-brown crystals, which are sometimes half an inch in diameter, occur, in association with wollastonite, pyroxene, sphene, plumbago, etc., in abundance in the crystalline limestone of the Township of Grenville (Argenteuil Co.), and it is of frequent occurrence, often in fine crystals, in the apatite veins of Templeton and adjoining townships (Ottawa Co.), Province of Quebec. Handsome crystals, including fine twins of zircon, are found in the Township of Sebastopol, also large and good crystals of the same in the adjoining Township of Brudenell (Renfrew Co.); in small crystals in a graphitic vein in the Township of North Burgess (Lanark Co.), and in a syenitic rock on Pic Island in Lake Superior, Province of Ontario.

276. MENACCANITE — See notes to "Ilmenite," "Iserite."

A Comment on U. S. Mining Legislation.

As a matter of course, various new bills regulating the conduct of the mining interest have been introduced in State legislatures. Some of these bills are good, some of them extremely bad. The average man who introduces a mining bill does not know what he is considering. For instance, a reckless or an ignorant man may introduce a measure which is impracticable because he does not know all the bearings of the case. He may demand weighing scales so located that placing them would involve a change of the whole works about a mine, or may propose something else equally impracticable. He wants reform but does not know how to secure it, and so goes at the task before him without any degree of sense or tact. He accomplishes, for all parties, infinitely more evil than good.

Most of the bills introduced of late increase the cost of mining without in any way benefitting the miner or the operator. Operators are not, at the present time, a greatly money-making class. What they are assessed in any way must by them be assessed somewhere else; the miner will endure no reduction. Indeed, he rather asks a constant advance, and the consumer must foot the bill in the end, else the coal industry would stop, manufactories cease operations and houses become cold in cold weather. This is the case as it stands.

Laws for the improvement of the condition of the miners and for the better adjustment of all the relations of life about coal mines must be broad and liberal. The rights of the miners must be considered and so must the rights of the operators. The former work hard and risk themselves in a difficult and dangerous manual occupation. The latter risk what money they have gained in what is yet an unsettled and fluctuating business. Each is entitled to consideration and each has rights. Legislators, looking for votes, sometimes overlook this fact. No doubt there could be accomplished good legislation regarding coal mining.

Conditions are changing and what was best a few years ago is not best now in all localities or under all circumstances. The fault is that the man who introduces the bill ordinarily does not know what he is talking about.—*Black Diamond.*

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French and Belgian Mines.—There are in France 1,363 conceded mines, including 636 of coal, 315 of iron ore, 279 of other ores, 82 of bitumen, plumbago, etc., and 51 of rock salt; but only 454 of the whole number are being actively worked, employing 123,664 hands. This figure is small compared with that of Belgium, the collieries alone of which little country number 110,000. The number of days worked by the 123,664 hands in France during 1888 was 33,162,966, corresponding to a sum of 122,490,604 fr. (£4,899,624), of which 113,840,957 fr. (£4,553,638) is the proportion of the collieries. The output of coal amounted to 22,172,029 tons, bearing a value of 229,128,895 fr. (£9,165,155).

MINING NOTES.

Nova Scotia.

(From our own Correspondents.)

Pictou County.

The old Mitchell mine opened by Mr. Thos. Turnbull, has been shut down again owing to water.

The Douglas slope has been connected by drifts across the measures to the Cage pit seam, and will shortly be in a position to make a strong output.

The very scant provision of cars by the railway people is felt seriously, and is interfering considerably with work at the Acadia and Drummond collieries.

The six-foot seam at the Vale is working fairly well and yielding satisfactorily; some trouble with water has been met with, but with a new Knowles pump and a good condenser it is hoped that this obstacle will be speedily overcome.

The old Foord pit is rapidly being overhauled, and under the new management of Mr. Wills, an English engineer of large experience, is beginning to look like a mine once more. At present something like 100 tons per diem are being raised. The new coal-cutting machine has not been long enough in operation to pass any verdict upon it.

Cumberland County.

A four foot seam of coal is reported to have been found at Parrsboro.

The output from the Joggins has increased from 100 to 300 tons per day, since Mr. Baird assumed management. Longwall, so far, has proved a paying innovation here.

Montagu District.

Tributers upon the Rose property are working upon the "iron lead" so called, and are reported to have fair ore.

The quartz from the DeWolfe lode is poorer than for some time past, the stopes being in ground, carrying few nuggets.

Mr. Skerry's work upon the Kaye property is reported as paying well, and work necessary for increasing the output is being pushed.

Molega District.

The new mill of the Boston Gold Mining Company completed its first month's run the other day, with a result of some 250 ounces. Manager Ballou expresses himself as exceedingly well pleased with the mill, which was designed and built by the Truro Foundry Co. An increased yield of about 40% is reported, upon both high and low grade ores, over the amount formerly obtained from the custom mill.

Oldham District.

The Concord Mining and Crushing Co. which began work here in September with a flourish of trumpets, suspended operations in the middle of January for a very indefinite period. Some twenty or thirty tons of rock were mined from the Sterling area, which gave about $2 per ton. It is said this rich rock would not pay expenses.

Fifteen Mile District.

The Egerton Co. are to add ten stamps to their fifteen stamp mill, and have given an order for another 40 h.p. compound condensing engine to I. Matheson & Co., New Glasgow. A second boiler has also been ordered. The prospects of this property never looked brighter.

Waverley District.

Supt. Hayward, of the Lake View Mining Co., claims that the paragraph in the January number of the *Review* in relation to his mill was inaccurate and unjust. He says that the reason the mill closed down was "because the foundry people didn't know how to make a cam." When asked whether it was the form of the involute or the quality of the metal that was at fault, he refused to say.

Salmon River.

A suit has been commenced by C. F. Mott, in the Supreme Court, against the former owners of the Dufferin mine, to compel an accounting of his (alleged) one-fourth interest in the mine.

The mine has for some time past been owned by the Dufferin Mining Co., (Ltd.), but was formerly owned by a number of individuals of whom the plaintiff was one. The mine was sold at public auction in March, 1888, when plaintiff's interest ceased, and the purchasers organized the present company.

Beaver Dam.

Supt. Turnbull reports the new mill in commission since December and working satisfactorily. The ore is in large amounts and the grade, though low, is yet high enough to give a margin for profit under the careful management which obtains on this property.

Quebec.

Eastern Townships.

The Johnson's Asbestos Company turned out close upon 1,400 tons of all grades last year.

The Central mine (A. H. Murphy & Co.), are operating on their lot with good results.

The Beaver Asbestos Company are extracting a good output, and their asbestos is of a good grade.

Messrs. King Bros. are opening up their Black Lake property, and getting ready for more extensive work in the spring.

At Thetford, Messrs. King Bros. are erecting a crushing plant, supplied by the Jenckes Machine Co., which we believe will be of great service in dressing the lower grades of asbestos.

The other mines are all in operation again after the regular holidays, and as usual are turning out fair quantities of fine grade asbestos, some lately taken from the Bell's Co. mine being especially fine.

The Anglo-Canadian Company are driving a tunnel in the hill back of the present workings and some good veins have been cut. Only one other pit is being worked at present.

The Laurier Mining Company have suspended operations for the winter. They met with but poor success; what asbestos they mined being No. 3, with a small quantity of No. 2.

The United Asbestos Company are working two pits at present, both of which are in good condition. A supply of water for the winter work has been provided by allowing the water to gather in the bottom of one pit while it is being widened on the top.

The works of the Scottish-Canadian Asbestos Company are still idle, but there seems to be a prospect of an early settlement of the unfortunate litigation which has tied up these promising properties. It is to be hoped that the valuable plant will soon be in operation.

The D'Israeli Company some time ago decided to close down, owing to non-success, and it is not likely they will re-open in the spring. The St. Julie Mining Company also came to the conclusion that serpentine rock with an insufficient quality of asbestos was not a very paying investment.

On Thursday evening, the 19th inst., Dr. R. W. Ells, of the Geological Survey, delivered a lecture in the Asbestos Club room at Black Lake, on "Asbestos: its distribution, mode of occurrence and uses." We hope in our next issue to give our readers a full report of this interesting paper.

Through a curious typographical error in our last issue the figures reported by Messrs. Irwin and Hopper as the output from the Anglo-Canadian Asbestos Co. for last year, were made to read 11,194 tons instead of 1,194 tons.

Owing to scarcity of water the American Asbestos Company have been obliged to stop most of their steam plant and work with hand drills. The work is carried on, however, with their usual energy, and with good results. The managing director, Mr. Ed. Wertheim, has been spending the winter months at the mine to "experience a Canadian winter;" he is not very favorably impressed with the conditions for work.

Work at the various mines has been greatly interfered with through January, by the great falls of snow. The weather has been unusually rough this winter; much trouble is experienced by the scarcity of water, some of the mines being without a sufficient supply for their boilers. All are working a reduced force at present. At Black Lake the Anglo-Canadian United American and Central Companies and King Bros., are the only ones working.

GOLD MINING SUPPLIES.

The principal depot in Nova Scotia, carrying the most complete assortment of first-class goods, is

H. H. FULLER & CO.'S

41 to 45 Upper Water St., Halifax, N.S.

Our line comprises Explosives, Fuse, American and English Mill and Hammer Steel, Bar and Bolt Iron, Steel Wire Hoisting Rope, Hemp and Manilla Rope, Rubber and Leather Belting, Miners' Candles, Oils and Lamps, Miners' Tools, Machinists' Tools, Blacksmiths Tools, and every requisite for the gold miner.

H. H. FULLER & CO.,
Halifax, N.S.

Dr. James Reed, Reedsdale, informs us that the output last year from his Black Lake property was 90 tons, sold mainly to the Chalmers-Spence Co., of New York. The property contains 300 acres and is situate on lots 27, 28 and 29, Range A, Coleraine. The mine is equipped with an Ingersoll plant of a value of $12,000.

The Central Company have, we understand, met with sufficient success to warrant them in putting up machinery to further develop their property across the Lake. There is apt to be some confusion in speaking of this company, owing to there being another company with the same name operating at Black Lake, viz. : A. H. Murphy and partners on lot 32.

The increase in the output of asbestos for the year just ended over that of the previous year, in connection with an increase in prices over 1889, shows that this branch of the mining industries is in a healthy condition. All of the old established mines have, during the year, added to their plants, so as to handle the rock with more speed, and the output of all these mines has increased in proportion. Many of the companies intend adding more machinery to aid them in the year's operations; much new ground will be opened up, and as a result, the output will be still larger for 1891. Of the many new "prospects" opened up in the neighborhood of Black Lake, there are only one or two that have "weathered the storm," the rest having closed down.

The output and exports of the Beaver Asbestos Company of Thetford, Quebec, during 1890, were as follows :—

	Production.	Export.
No. 1 quality	$41\frac{1040}{2000}$	36
No. 2 "	$80\frac{980}{2000}$	$78\frac{1900}{2000}$
No. 3 "	$50\frac{1000}{2000}$	$50\frac{300}{2000}$
Waste	$1\frac{400}{2000}$	$1\frac{400}{2000}$
	$173\frac{1420}{2000}$	$166\frac{600}{2000}$

On hand, January 1, 1891, $7\frac{820}{2000}$.

Templeton District.

Messrs. Fee and McDonald have a small force at work on the old Jackson Rae mine.

From the month of December to date, about 80 tons have been taken out of the Lepage property, in the 4th Range. Three pits are worked ; 22 men employed.

At the works of the MacLaurin Phosphate Mining Syndicate (Limited), 40 men are employed, and the monthly yield is in the neighborhood of 150 tons.

The Blackburn mine continues to yield a monthly output satisfactory to the owners, the returns for January showing a yield of 500 tons from a force of 100 men.

The Charett phosphate property, situate on the 11th Range of Templeton, 300 acres in extent, has been purchased by the Messrs. MacLaurin. The price paid, we are informed, was $5,000 cash.

The property owned by Dr. A. S. Thompson, of Toronto, has been shut down for the winter, the pits making too much water. Dr. Thompson will put in a steam plant in the spring.

The property of the North American Company, now worked under agreement by Messrs. Lomer, Rohr & Co., is yielding, on an average, about 150 tons per month, with a force of 15 men.

The property of the Templeton and Blanche River Phosphate and Mining Company, has, we understand, passed into the hands of a European syndicate, through the agency of Messrs. Millar & Co., Montreal. Active work was resumed this month. The property is situate in the 9th, 10th and 11th Ranges, East Templeton.

Mr. James MacLaurin has a force of 30 men operating on the north half of lot 8, on the 12th Range, from which, since work was begun, nearly a year ago, about 400 tons have been raised. This mine is equipped with a really good plant, including Ingersoll drills, 40 h. p. boiler (Waterous), steam hoists, etc., etc.

Another well equipped mine is that now operated by Mr. Hector McRae, of Ottawa, the plant comprising Ingersoll steam drills, Ingersoll hoist, boilers, Worthington pump (Northey make), derricks, diamond drill, etc., the whole of an estimated value of $7,500; 28 men are employed. It is estimated that 250 tons have been raised since work was begun in the fall. The prospecting drill has been purchased from the American Diamond Rock Boring Co., New York. The utility of the prospecting drill for demonstrating the value of phosphate, asbestos and other mineral properties, has been already commented on in these columns, and its introduction in this district should mark a new era in mineral development. The cost of boring a number of test holes at different angles to a depth of 150 to 200 feet should, when the machine is on the ground, not exceed sixty cents per foot. Mr. McRae we believe, has already contracted for the use of his drill on properties in his vicinity, at a reasonable figure.

Lievres District.

The output from the Canadian Phosphate Company's mines for last month amount to 400 tons of all grades.

Official returns from the Phosphate Lime Company's mines at High Rock, show a yield of 609 tons for the month of January.

Mr. Jacob Weart of Jersey City, N.Y., is equipping his graphite property in the township of Buckingham with a first class machinery plant, with a view to an immediate commencement of active mining.

The General Phosphate Corporation (Limited), are doing some work on their Ross Mountain, High Falls and Murphy properties. Mr. Wills, the manager, is, however, very reticent and declines to say anything about results. A portion of their plant is in place, but the full equipment will not be required before spring.

The Emerald Mine, formerly owned and operated by the Ottawa Mining Company; is now worked by an American syndicate under title of the Emerald Mining Co. Mr. S. P. Franchôt will, as heretofore, manage these old established mines. A notice of the new company appears elsewhere.

The value of the exports of merchantable mica was :—

March quarter	$ 90 00
June quarter	nil
September quarter	163 20
December quarter	850 40
	$1,103 60

The value of the exports of feldspar for this district during 1891, as per official returns, kindly furnished by Col. Lay, U. S. Consul General at Ottawa, is as follows :—

June quarter	$1,222 50
September quarter	1,000 00
	$2,222 50

or at $8 per ton, a little over 277 tons. Mainly from the Villeneuve mica mines.

Temiscaminge.

Mr. John Williams, of New York, who has been acting here as consulting engineer at the silver-lead mines, owned and operated by Mr. R. W. Chapin, of the Ingersoll-Sergeant Co., New York, has accepted an appointment with the Kansas City Smelting and Refining Co. Mr. Williams is perhaps better known as associate-editor of our esteemed contemporary the *Engineering and Mining Journal*, and our hearty good wishes go with him to the new sphere of his labors. A force of 30 men are employed at the mines, a reduction having been made for the winter months. Sinking and cross-cutting are, in the main, the work going on at present.

Pontiac County.

The Bristol Iron Co., (Ltd.), have leased, for a period of years, to Messrs. Ennis & Co., New York, the mines owned by the company in the County of Pontiac. The exports of ore for 1890 are reported as follows :—

March quarter	$ 5,253 10
June quarter	4,950 74
September quarter	4,708 78
December quarter	7,321 85
	$22,234 47

Mr. E. C. Williams has assumed the management of the works. Additions to the plant will be made forthwith.

Ontario.

Kingston District.

The Blessington Mining Company have closed down the Silver Lake, St. George's Lake and Bedford mines for the winter, and are only running their old No. 1 and No. 2 shafts at Eagle Lake mine, at which about 30 men are employed. A strike of high grade phosphate has been made in the old No. 1, while a number of tons of low grade have been mined from the "Discovery."

The development of Silver Lake mine has been carried on rapidly during the past summer ; some very good ore has been met with, and it is estimated that some 3,000 tons are in sight. This mine will be opened again early in the spring, with a large force of men, and a big output is expected. A siding will be put in by the Canadian Pacific railway to this mine.

Only about 1,200 tons have been shipped from these mines during the past season owing to the heavy development work that has been carried on. Capt. Boyd Smith, the proprietor, with Mr. Pickford, of London, Eng., are travelling together through Florida, examining the phosphate districts of that region, in which they are much interested. Supt. Harris is still in charge of the Blessington mines.

Port Arthur District.

At the Badger, No. 1 adit level on No. 4 vein has been driven 660 feet, and has now a total length of 872 feet. Depth of shaft 130 feet. No. 2 level has been started from the bottom of the shaft and has been driven 80 feet west. Three winzes have been started down from No. 1 adit, each 140 feet apart, and to be driven through to No. 2 level before any stoping is done. Two upraises have also been started. They are 30 feet above the roof of the level, and have not yet reached the top of the ore body. These upraises are 160 feet apart and show the quality of the ore to be uniform throughout. The vein has been left standing in No. 1 and No. 2 levels; in No. 1 it averages 3½ feet in width, and in No. 2, 4 feet. The portion left standing in No. 1, 500 feet in length, averages 200 ounces to the ton, exclusive of a streak of high grade ore, principally of native silver, which lies on the hanging wall. It is from 4 to 10 inches in width and averages 2,000 ounces to the ton. Wherever it has been opened there is a band or streak of carbonate of baryta, "witherite," next to the native silver on the hanging wall. This band is also found on the hanging wall in the lower level. The vein is steadily improving in width and quality of the ore as depth is attained. In No. 3 vein an adit has been driven 300 feet. The vein is well defined, having an average width of 3 feet, and carries good milling ore. A winze is being sunk near the breast of the level, which shows the vein to be improving. In No. 2 vein a shaft 130 feet in depth has been sunk, and an adit level 570 in length has been driven. This vein has produced some very high grade ore ; it averaged 2,000 ounces in the stopes, some bunches going as high as 10,000 ounces to the ton. The West End vein is looking well. A 200 foot level has been driven on the vein. A winze is being sunk near the junction of No. 1 vein. It is now down 20 feet. Some of the ore in this vein is high grade, the average being about 80 ounces to the ton. The total shipments since August 1st last have aggregated 128 tons of ore, and concentrate, valued at $150,000 ; 17 tons of smelting ore are now on hand ready for shipment. Press rumors to the effect that the owners are hawking this property around, endeavoring to sell it, are entirely without foundation.

At the Shuniah Weachu work on No, 4 shaft has been suspended for the present, the company deeming work on No. 3 to be sufficient for all exploratory purposes.

Since 1st August last year, seven carloads of concentrates and smelting ore have been shipped by the Beaver Mining and Milling Co., valued at $130,000. The mill is treating 30 tons daily. An addition of 10 head stamps to the milling plant is now contemplated.

A new engine and boiler have been put in at the Murillo mine, and a contract let to sink shaft 100 feet. The shaft has been pumped out, and sinking was commenced on the 8th inst. It is intended to thoroughly explore and test this property. The work is under the superintendence of John S. Winder.

Sinking is being continued on No. 3 with very encouraging results. A considerable change is taking place in the nature of the formation at the bottom of the shaft or the 735 foot point. Development work is being carried on on the several small veins traversing the mountain. The stock of mill rock is receiving substantial additions daily from these veins averaging from 15 to 20 ounces per ton.

Manitoba and North-West Territories.

The province of Alberta, on the east foot of the Rocky Mountains in British Columbia, promises enormous mineral wealth, according to the preliminary report of Mr. W. S. Drury, of the Dominion Topographical Survey. In this region anthracite coal is reported in seams 20 to 50 feet thick ; copper ore 28% fine, silver, lead and gold have been discovered. Evidence also goes to show that petroleum fields underlie the plains of Alberta, and natural gas is there already utilized in a limited degree.

A petition has been addressed to the Minister of the Interior, by his constituents in Southeast Assiniboia, asking that the attention of the Government be called to the urgent necessity of at once building a railway to the Souris coal fields, the want of which is causing great dissatisfaction through loss of time and money. Fuel has to be hauled from Turtle Mountain or the Souris coal fields, a distance of over 120 miles apart ; and the inhabitants of the district claim that they have been harshly used, as the road has been contracted to be built, and has never been commenced.

British Columbia.

Kootenay District.

The fact of the Silver King tunnel being in solid ore, with walls nowhere visible, has stiffened the prices of Nelson real estate, owners claiming that the future of the town is assured because of its having at least one rich mine immediately tributary, to say nothing of other tributary properties like the Poorman, the Dandy, the Grizzly, the Iroquois, the Whitewater and the Toughnut, all believed to be good, and a number of undeveloped properties which promise good returns.

A good deal of work is being done in the gold claims between Eagle and Forty-nine Creeks. The Poorman, the Wild Cat, the Pioneer, the Paradise and the Royal Canadian all have men at work upon them. A tunnel is being run on the Poorman, and the same on the Wild Cat. Search is still being made for the ledge in the Paradise, and in the Pioneer and Royal Canadian tunnels are being pushed forward. All these claims have ore in sight, and their owners hope to have enough in sight by spring to justify the erection of reduction works somewhere near the junction of Eagle Creek with Kootenay River.

On the Neosho, the shaft is down 40 feet, with a good sized body of high grade ore in its bottom. This is one of the promising undeveloped claims of the district. The two-compartment shaft on the Skyline is down 100 feet and it is expected that another hundred will have to be sunk before the ledge is struck. If not struck at a depth of 200 feet, a station will be put in, and a cross-cut run to the ledge. The shaft on the tenderfoot is down 34 feet, ore all the way. Assays give returns of 38 to 45 ounces of silver to the ton. The working shaft on the United property is down 65 feet. Drifts on the ledge are now being run both ways from the shaft. On the Dictator work is progressing favorably in the new tunnel, in 112 feet. The ledge is expected to be reached in another 50 feet, which will top it at a depth of 100 feet below the old workings. In doing the assessment work on the Maggie, a strong ledge, carrying coarse cubical galena was exposed.

Much has been said about the amount of ore in sight in the Silver King mine on Toad Mountain and of the apparent value of that property as a mining proposition, but until last week these statements could not be verified. It was known that the ore-body in the bottom of the incline shaft was 45 feet wide, with but one wall exposed; but its length or depth was not known. Three weeks ago the same character of ore as that in the ore body in the shaft was encountered in the floor of the tunnel, its size increasing as the tunnel was advanced. Last week the tunnel was in solid ore too, that assays higher if anything than that taken from the cross-cut in the shaft. The face of the tunnel is now about 80 feet distant from the bottom of the shaft, and it is not unreasonable to maintain that the Silver King ore-body is at least 80 feet in length. If 80 feet in length and 45 feet in width, with an average depth of 20 feet, there is more money in sight in the Silver King mine than in any other mine in America at the same depth—162 feet. The ore is high grade gray and peacock copper, averaging over $200 in silver to the ton, and can be shipped without sorting. A careful estimate, based on 7 cubic feet to the ton, gives at least $2,500,000 in sight, not estimating the value of the low grade ore in sight on the surface.

The new work at present being undertaken by the New Vancouver Coal Company continues to be making rapid progress. No. 4 Shaft, in which considerable work has been already accomplished, is now down, including the slope, about 1,000 feet and as it is still in course of progress, it may be presumed the Company anticipate in the future of being able to increase the output. No. 5 Shaft, which is also situated close to Southfield, is in course of sinking, and since it was first started a few weeks ago the work has been strenuously pushed forward with every possible despatch. The distance gone is already 160 feet, but nothing of importance has been met with. The drilling is being accomplished by the use of compressed air drills, which so far have worked with great satisfaction. The new shaft on Protection Island is down about 6 feet, but work will stand for a few days until the contract is let for its continuation. An engine house has been erected on the Island and close to the shaft, the machinery for which is being rapidly taken over there and fitted up for the purpose of sinking. The drilling will be done by means of an air compressor of the most modern design. This work is expected to be completed some time during the summer.

CANADIAN COMPANIES.

Bell's Asbestos Company (Ltd.)—Mr. H. A. Bell has been appointed the managing director of this company.

The Sheridan Manufacturing Company of Toronto (Ltd.)—Have been incorporated under Ontario laws to do a general foundry and machine shop business; to manufacture furnaces and heating apparatus. Head office, Toronto. Capital Stock, $12,000.

Joggins Coal Mining Association (Ltd.)—At the annual meeting of the stockholders of the Joggins Coal Coal Mining Association, held at St. John, the old directors were re-elected. The Canada Coal Company, now operating the mines under an option of sale, asked extension of time in which to complete the purchase. A committee of three was appointed to deal with the matter.

The North Shore Nickel Mining Company (Ltd.)—Application will be made to the Ontario Legislature for the incorporation of the above company, with power to acquire, sell and deal in mining claims and lands in Ontario; to work and operate the mines thereon; to smelt and refine minerals, and generally to carry on a mining business in the District of Algoma and elsewhere. Head office, Toronto. Capital, $500,000, in 100,000 shares of $5 each. The applicants are: H. N. Baird, J. Carruthers, J. H. Sproule, J. Taylor, Toronto, and J. M. Whitlaw, Buffalo, of whom H. N. Baird, J. Carruthers, and J. Taylor are to be the first directors.

The Cant Bros. Company of Galt (Ltd.)—Letters patent have been issued under the Ontario Joint Stock Companies Act, incorporating John Cant, Hugh Cant, B. Maurer, H. A. Cant, A. B. Thom, Galt, and A. Cant, Buffalo, N Y., for the purpose of manufacturing all kinds of iron-working and wood-working machinery and tools. Head office, Galt. Capital stock, $40,000, in 400 shares of $100 each.

Clementsport Iron Company (Ltd.)—Notice is given that application will be made to the Dominion Parliament to incorporate the above company with power to acquire mining property and mining rights, by deed, lease or otherwise, and to acquire, buy and sell lands, machinery, water power and other property real and personal, and with power to erect on said lands smelting works, and to operate the same. Head office, Annapolis Royal, N.S.

The Canadian Copper Company.—The annual meeting of this company was held in Cleveland, O., on the 5th ult., when Messrs. George G. Allen, Stevenson Burke, C. W. Bingham, T. W. Cornell, and H. P. McIntosh were elected directors, and the board was organized with the following officers: Stevenson Burke, president; T. W. Cornell, vice-president, and H. P. McIntosh, secretary-treasurer.

The Toronto Drop Forge Company (Ltd.)—Application will be made to the Ontario Legislature for the incorporation of this company, to manufacture iron, steel and copper forgings, architectural and other iron work. Head office, West Toronto Junction. Capital Stock, $40,000, in 400 shares of $100 each. Applicants: W. Mathers, R. T. Howard, Toronto; J. H. Hoover, R. L. McCormack, West Toronto Junction; T. Mulvey, Toronto, all of whom are to be the first directors.

Central Lake Mining Company.—This company has been formed to acquire and work phosphate mines, more particularly lots 7, 8, 9 and 10, in the Township of Portland West, P.Q. The principal owners are: S. P. Franchot, Buckingham, P.Q.; M. W. Barse, Olean, N.Y.; N. V. V. Franchot, Olean, N.Y.; DeWitt Lefebvre, Olean, N.Y.; Capt. Macnaughton, Buckingham, Que. Superintendent: Capt. Joseph Gilchrist, P.O. High Rock, Que.

The John Doty Engine Company of Toronto (Ltd.)—Letters patent have been issued under the Ontario Joint Stock Companies Act, incorporating J. Doty, F. H. Doty, F. W. Doty, D. Hunter, and J. F. Walshe, Toronto, under the above title, with power to manufacture engines, boilers and other machinery; to do a general foundry business, and establish agencies for the carrying on of the same. Head office, Toronto. Capital Stock, $250,000, in 2,500 shares of $100 each.

The Essex Brass and Iron Company of London, Ontario (Ltd.)—Letters patent have been issued under the Ontario Joint Stock Companies Act, incorporating J. Essex, A. T. McMahon, A. Richardson, H. Richardson, J. Graves, G. Walters, H. W. Blynn, London, and R. Fox, Lucan, under the above title, for the purpose of carrying on a general brass and iron foundry business, including the manufacture of all kinds of brass, iron and other metal goods, electrical and other machines and appliances, and to act as general metal dealers and smelters. Head office, London, Ont. Capital Stock, $30,000, in 600 shares of $50.

Emerald Phosphate Company.—This company has been organized under the laws of the State of New York, for the purpose of acquiring and working the phosphate lands and mines formerly owned and operated by the Ottawa Phosphate Mining Company, situate in the Township of Buckingham, County of Ottawa, P.Q., better known as the Emerald Mine. Capital, $30,900 in shares of $50 each, all subscribed. President, A. P. Strong, Schenectady, N.Y.; secretary-treasurer, S. W. Jackson, Schenectady, N.Y.; managing director, S. P. Franchot, Buckingham, Que.; mine superintendent, Capt. R. Henwood. Canadian office, Buckingham, Que.

Deadwood Mining Company.—Incorporated 20th January, 1891. Authorized Capital Stock, $25,000, divided into 250 shares of a value of $100 each. $18,000 subscribed. Directors: A. D. Whittier, president. W. C. Haywood, J. E. Crane, J. A. Whittier, H. S. Sharpe. Head office: W. C. Haywood, secretary, Victoria, B.C. Formed to purchase, work and develop gold mines and other mining properties; to prospect, negotiate for, take up, license or lease, acquire, buy and sell the same, and to do a general mining business. The property owned contains 96 acres of gravel bar situate on the Fraser river, near Lillooet, in the province of British Columbia; ten men employed. Mine superintendent, J. A. Whittier, Victoria, B.C.

The Crescent Gold Mining Company of Marmora (Ltd.)—Application will be made to the Governor-General-in-Council to incorporate this company for the purpose of acquiring lands in the Province of Ontario, and mining for gold, iron or any other mineral therein contained, and with power to erect milling and smelting machinery, together with all other customary powers. Head office, Malone, in the Township of Marmora, Ont. Capital Stock, $250,000, divided into 2,500 shares of $100 each. The applicants are: Peter Peterson, Charles R. Hosmer, Robert Benney, Montreal; Herbert C. Hammond, Toronto; John McFee, Belleville; Thomas Watson, Montreal. The provisional directors of the company are to be: Peter A. Peterson, Charles R. Hosmer, H. C. Hammond, Robert Benny and J. McFee, all residing in Canada.

The Londonderry Iron Company (Ltd.)—The annual general meeting of the shareholders of this company was held on the 11th inst. The old board of directors were re-elected without change, viz., Sir George Stephen, Bart., president; Sir Charles Tennant, A. S. McLelland, Glasgow; Hon. D. McInnes, A. T. Paterson, John Turnbull, and R. McD. Paterson. The reports presented were of a most encouraging nature, and the outlook for the coming year is very much brighter than it has been since the organization of the company. A balance was placed to the credit of the Reserve, and a considerable sum allocated to improvements in the shape of machinery, plant, etc., which will materially increase the producing power and the business of the company in the future.

Canadian Smelting and Refining Company (Ltd.).—Letters patent under the Nova Scotia Joint Stock Companies Act, have been granted, incorporating the above company, for the purpose of buying, selling and otherwise dealing in mines, mining areas, quarries, ores and mineral substances of every description; to reduce and smelt any ores; and to own and operate petroleum lands and wells, etc., together with the usual powers as regards real estate and financial operations. Head office, Yarmouth, N.S.; Capital Stock, $100,000 of 100,000 shares of $1 each. The applicants are: Edgar K. Spinney, Yarmouth, N.S.; Edward S. Williams, Yarmouth; Steven B. Murray, Yarmouth; Albert M. Perrin, Yarmouth; E. Franklyn Clements, Yarmouth; George E. Lavers, Yarmouth; Joseph R. Wyman, Yarmouth, and Herbert H. Brown, Glasgow, Scotland.

The Toronto Mining Association (Ltd.)—Notice is given that letters patent have been issued under the Ontario Joint Stock Companies Act, incorporating the above with power to (*a*) invite by correspondence and otherwise, owners of property, prospectors and others who wish to develop mining claims or to place them on the market, to send to the association a description of the same, with samples of such properties, to be examined; and to negotiate as agents for the sale or purchase of such claims, mines or minerals after examination or further development. (*b*) To acquire, compile, publish and distribute information received regarding mineral resources generally, all of which shall be open to members in good standing; and (*c*) to establish connections to carry out the above purposes, by forming branch associations, correspondence and otherwise. Head office, Toronto. Capital Stock, $3,000, in 300 shares of $10 each. Those incorporated are: J. S. Lockie, C. S. Gzowski, jr., W. H. L. Gordon, T. D. Ledyard, T. H. Smythe, C. G. Richardson, C. S. Morris, J. J. Gartshore, A. B. Barry, J. L. Thompson, J. S. Monahan, A. S. Thompson, Toronto, and T. M. Irvine, Peterborough.

The Ottawa Powder Company.—Application will be made to the Governor-General-in-Council for letters patent incorporating this company for the purpose of purchasing, manufacturing and dealing in gun and blasting powder, fuses, detonators, dynamite, nitro-glycerine and other explosives and their constituents, and in batteries and appliances used in connection with explosives. The purchasing, manufacturing and dealing in all kinds of machinery, plant, fixtures, chemicals, appliances and constituents required in the manufacture and use of explosives, and the usual powers as regards inventions, property, etc, Head office, Buckingham, Ottawa County, Quebec. Capital Stock, $25,000, in 250 shares of $100 each. The applicants are: Adolph Lomer, Montreal; John F. Higginson, Buckingham; S. P. Franchot, Buckingham; John F. Patton, Ottawa, and Walter A. Williams, Buckingham. Adolph Lomer, J. F. Higginson, S. P. Franchot, J. F. Patton and W. A. Williams to be the first or provisional directors of the company.

The Golden and East Columbia Railway Company (Ltd.)—Application will be made to the Dominion Parliament for the incorporation of the above company with power to construct and operate a railway from the international boundary at or near the intersection of the same by the Upper Kootenay River, and from thence in a north-easterly direction, following the valley of the Columbia River to Golden City, and thence continuing up the said valley to the Boat Encampment at the mouth of the Canoe River, in British Columbia, with power to connect with any line or lines of railway, with all powers conferred by the "Railway Act;" and to construct and operate telegraph and telephone lines; and with power to buy, lease, acquire, sell and mortgage land and real estate, including coal and other mineral lands and mines; and to mine coal and other minerals; and to manufacture and to sell the products of such mines and lands; and with power to purchase, construct and erect machinery and plant for the smelting, reduction, or other treatment of mineral ores of all kinds. Head office, Calgary, Alta.

Drummond McCall Pipe Foundry Company.—Notice is given that application will be made to the Governor-General-in-Council for letters patent incorporating the above company, with power to manufacture cast iron water, gas and other pipes, and all classes of foundry work; to deal and trade in the same and all material required for the said manufacture and all the various products thereof; to acquire, purchase, lease or license all kinds and descriptions of machinery, devices, systems, process or invention, whether patented or not, designed for or adapted to the manufacture of the aforesaid articles; to purchase lease or otherwise acquire any real or personal property, rights or privileges which may be deemed necessary or convenient for the purposes of carrying on the business of the company, and generally to do all such other things as may be required or are incidental to or conducive to the attainment of the objects aforesaid, or any of them. Head office, Montreal. Capital Stock, $60,000, divided into 500 shares of $100. The applicants are: G. E. Drummond, J. T. McCall, T. J. Drummond, Montreal; T. F. Griffin, Detroit, Mich.; D. H. Gilbert, Lachine, P.Q., of whom G. E. Drummond, J. T. McCall and T. F. Griffin are to be the first or provisional directors of the said company.

Montreal Water Power Company.—Notice is given that application will be made to the Quebec Legislature for the incorporation of this company with power to contract for, construct, operate and maintain a system, or systems of waterworks, for the supply of water to cities, towns, villages and other municipalities, corporations and individuals in the Province of Quebec, and for said purpose to construct all necessary works upon the rivers and streams in the said Province; to contract for, construct, operate and maintain a system, or systems, and for the supply of electric light and power within said Province, and for all the aforesaid purposes the company will ask that the powers granted by section 5132 of the Revised Statutes of the Province, to railway companies, in so far as the same can be made to apply to the proposed company, be incorporated in the letters patent, and that where reference is made, in said section, to the line of railway and works, that in so far as the proposed company is concerned, the same shall be construed to mean lines of pipes and wires and the works of said company, without prejudice, however, to rights which said company may acquire under section four, of chapter five, title one, of the second book of the municipal code of the Province. Head office, Montreal; Capital Stock $2,000,000, divided into 20,000 shares of $100 each. The applicants are: Thomas J. Drummond, Raymond Préfontaine, Q.C., Montreal; John F. Moffet, Watertown; E. C. A. Woltmann, New York; Richard White, Montreal; George E. Drummond, Montreal; James T. McCall, Montreal; H. C. Hodgins, and Charles T. Moffet, Syracuse N.Y.; John V. Clarke, and George T. Keith, New York. T. J. Drummond, R. Prefontaine, G. E. Drummond, J. F. Moffet, E. C. A. Woltmann, Richard White and H. C. Hodgson are to be the first or provisional directors.

The Wahnapitæ Nickel Company (Ltd.)—Application will be made to the Ontario Legislature for the incorporation of the above company, to acquire and otherwise deal in mining claims and mines in the District of Algoma and elsewhere in Ontario; to operate mines and smelt and refine minerals. Head office, Toronto. Capital Stock, $150,000, in 6,000 shares of $25 each. The applicants are: O. J. Wells, G. B. Foster and T. W. H. Leavitt, all of Toronto, who are to be the first directors.

The Dunnville Natural Gas Company (Ltd.)—This company will make application for incorporation to the Ontario Legislature for the purpose of boring and drilling for natural gas, and supplying the same, etc., in Dunnville. Head office, Dunnville, Haldimand county. Capital Stock, $5,000, in 200 shares of $25 each. Applicants: F. J. Ramsay, G. A. McCallum, G. S. Middaugh, R. F. Lattimore, J. Brown, J. Nichol, H. Penny, L. A. Congdon, J. Taylor, J. A. McIndoc, J. H. Smith and W. D. Swayze, all of Dunnville, who are to be the first directors.

The Farmers' Natural Gas and Oil Company of Gosfield (Ltd.)—Application will be made to the Ontario Legislature for the incorporation of this company, for the purpose of acquiring land in the county of Essex and elsewhere, and sinking wells for natural gas or oil therein; for refining the products and using or supplying them for manufacturing purposes, with the customary powers. Head office, Windsor. Capital Stock, $100,000, in 2,000 shares of $50. Applicants: H. H. Lypps, township of Gosfield South; J. G. Leggatt, J. A. Smith, A. H. Clarke, Windsor, and C. H. Delisle, Walkerville, all of whom are to be the first directors.

The St. Catherines Hydraulic Improvement Company (Ltd.)—Application will be made to the Dominion Parliament for the incorporation of the above company, with power to develope and improve manufacturing industries, water power and hydraulic privileges in the counties of Lincoln and Welland, Ontario. Also to construct and operate hydraulic machinery, etc. Head office, St. Catherines, Ont. Capital Stock, $40,000, in 4,000 shares of $100 each. The applicants are: G. F. Peterson, C. J. Benson, S. Montgomery, S. E. Lindsay and H. G. Hunt, all of St. Catherines; of whom G. F. Peterson, S. Montgomery and S. E. Lindsay are to be the first directors.

Latest Stock Quotations of Canadian Companies in England.

	Price.	
Excelsior Copper, Limited, £410,738 fully-paid shares of £1	——	
Nicola, Limited, £35,000 fully-paid shares of £1	——	
Shuniah Weachu, Limited, £99,888 fully-paid shares of £1	——	
Silver Wolverine, Limited, £68,465 fully-paid shares of £1	——	
Tilt Cove Copper, Limited, £160,000 fully-paid shares of £2	——	
Ditto, £80,000 5½ per cent. debentures	——	
General Mining, Limited, £219,752 fully-paid shares of £8	3½	4
Low Point, Barrasois and Lingan, £509,100 fully-paid shares of £100	——	
New Vancouver Coal Mining and Land, Limited, £185,000 fully-paid shares of £1	¾	1
North-Western Coal and Navigation, Limited, £160,500 6 per cent. debenture coupons, June 30 and December 31; principal 1904	——	
Ditto, £149,500 fully-paid ordinary shares of £10	——	
Ditto, £900 fully-paid deferred shares of £100	——	
Sydney and Louisburg Coal and Railway, Limited, £50,000 cumulative 10 per cent. first preference shares of £10, £6 paid	7½	8½
Ditto, £14,560 fully-paid non-cumulative 6 per cent. second preference of £10	3	5
Ditto, £250,000 fully-paid ordinary shares of £10	¼	¾
Anglo-Canadian Asbestos, Limited, £11,500 fully-paid shares of £2	——	
Anglo-Canadian Phosphate, Limited, £46,510 fully-paid preference shares of £10	——	
Ditto, £25,000 fully-paid deferred shares of £10	——	
Bell's Asbestos, Limited. £140,000 fully-paid shares of £5	11⅞	12⅛
Ditto, £68,400 debentures, 5 per cent.; interest January 1 and July 1	——	
Canadian Phosphate, Limited, £100,000 fully-paid shares of £1	——	
General Phosphate, Limited, 5 per cent. ordinary shares of £10, £2 paid	——	
Ditto, £5,000 fully-paid founders' shares of £10	——	
Western of Canada Oil, Limited, £200,000 fully-paid shares of £100	——	
Ditto, £99,850 fully-paid shares of £50	——	
Western of Canada Oil, Limited, £199,700 12 per cent. debentures of £100	——	
White's Asbestos, Limited, £20,000 fully-paid shares of £1	——	
Ditto, £15,000 shares of £1, with 15s. paid	——	

Excelsior Copper.—Registered September 26, 1888. Accounts to December 31 submitted in April. No dividend yet. Liquidation and reconstruction have been decided upon.

Nicola.—Accounts to December 30 submitted in November. No dividend yet.

Shuniah Weachu.—Accounts to November 20 submitted in February. No dividend yet. Shares for £12,870 held by the Company.

Silver Wolverine.—Registered October 19, 1888. Annual meeting to be held about March 1891.

Tilt Cove.—In March, 1890, the properties were leased for 99 years to the Cape Copper Company, Limited, at a rent of £4,400. The Cape Copper Company advance £15,000 at 5 per cent. interest, and when this is repaid out of profits; surplus profits are to be divided equally between the Cape Copper Company and the Tilt Cove Company. The lease may be determined by the Cape Copper Company at any time on twelve months' notice. Accounts annually to March 31 submitted in November.

General Mining.—Accounts to December 31 submitted in April, but an interim meeting is held in November. Dividend for 1884, 5 per cent.; for 1885 and 1886, 3⅛ each year; for 1887, £4 13s. 9d. per cent., and for 1888 and 1889, 3¾. Reserve fund, £29,850.

Low Point.—Accounts to December 31. For 1887, 1888, and 1889, 5 per cent was paid each year on the ordinary shares publicly held; for 1888 the ordinary shares issued to the vendors got 3½ per cent., and for 1889, 2½.

New Vancouver Coal.—Reconstructed in 1889. Accounts to June 30 and December 31 submitted in November and May. For the two half-years to June, 1889, 5 per cent. per annum was paid, and for the two half-years to June, 1890, 4. Debentures, £57,700.

North-Western Coal.—The deferred shares receive no dividend until 15 per cent. per annum (cumulative) has been paid on the ordinary. Accounts to June 30. Dividend for 1887-8 and 1888-9, 5 per cent. per annum.

Sydney and Louisburg Coal.—Accounts to December 31 submitted about May. In respect of 1889 15 per cent. was paid on the first preference, leaving arrears of 50 per cent.

Anglo-Canadian Asbestos.—Reconstructed in 1889. Debentures, £3,450.

Anglo-Canadian Phosphate.—The preference shares rank first for 7 per cent., and after a like rate has been paid on the deferred shares, both classes rank equally. Accounts to November 30, submitted in May. No dividend yet on either class. Debit to profit and loss on November 30, 1889, £4,784. One of the mines has recently been sold and another leased.

Bell's Asbestos.—Accounts to December 31 submitted in January. Dividends for 1888 and 1889, 22½ per cent. each year. Reserve, £5,000. The debentures are redeemable by 1913, by annual drawings at 115 from a sinking fund, which the directors may increase.

Canadian Phosphate.—Accounts to November 30 submitted in February. Eleven months to November 30, 1888, resulted in a profit of £2,576. which was carried forward. A dividend of 6d. per share is to be paid November 1, 1891.

White's Asbestos.—Registered April 9, 1889. Accounts submitted on December 31. Liquidation has been decided on. See meeting of company in this issue.

The Profits of Coal Mining.

What the exact average profits realized on coal mining may be there are, unfortunately, no means of ascertaining. The individual profits of an individual colliery are, of course, supposed to be ascertained and stated from time to time in the reports of limited liability companies, such as North's Navigation Collieries and others. But these seldom provide a guide that can claim to be trustworthy to the matter in hand, since many of the chief coal-owning concerns—such as the Ebbw Vale, the Blaenavon, and the Rhymney companies, in Wales; the Consett Company, Bolckow, Vaughan and Company, and other coal owning concerns in the north of England; and still others in other localities—carry on the coal business simply as an adjunct to another and, to them, more important enterprise, such as the smelting of pig iron, or the manufacturing of steel. The largest coal owning concerns do not state the profits or losses—as the case may be—derived from coal mining, as such. But it has been found, again and again, that the ownership of collieries, in connection with manufacturing businesses, has not been a source of profit. This fact has been made apparent within the last year or two in the experience of two of the largest manufacturing concerns.

There is one set of returns that ought to be very valuable for the purpose of determining the profits realized in the coal industry from year to year—the returns of the gross annual value of the profits, &c., of the mining industries of the United Kingdom assessed to income tax. It is, of course, well known that the income tax returns specifically deal with iron and steel works, mines, railways, quarries and canals as industrial enterprises, but as the returns that relate to mines fail to make any distinction between coal mines, and mines devoted to iron, copper tin, lead and other minerals, it is impossible to say how far the incorporation of the returns relating to the last named minerals would be likely to influence the general result. They are, at any rate, of sufficient importance to render it quite unsafe to generalize on the subject from the point of view of any single mining industry, although coal may be regarded, in reference to British mining, as the London and North-Western Railway is in reference to British railways generally—that is to say, as the controlling factor. Taken for what they are worth, subject to the vitiating element just pointed out, the income tax returns show that in the United Kingdom the mining industry—and presumably the coal mining industry in particular—has been one of diminishing profits over a considerable series of years. The profits in some years would appear to have averaged as much as 2s. 6d. per ton, while other years they have fallen to 8d. and 9d. per ton, and the latter figure has been the usual average up to a year or two ago, including all minerals, so that it may be taken that for coal, the cheapest mineral of all, taking it all round, the average rate of profit must have been very low indeed. It has been much the same in reference to the most closely-allied industry—the iron and steel trades—the available income-tax returns showing that the average profit per ton of iron and steel produced was as much as 15s. 10d. in 1874, and fell from year to year during the fourteen years that next followed until in 1888, the average profit—that is, of course, taking an average of the three preceding years, as required for income-tax purposes—was not more than 1s. 10d. per ton. It is true that in spite of this diminution of profit, there was in the iron and steel, as in the coal industry, a large increase of production, the total quantity of pig iron, finished iron and steel of all kinds manufactured in the United Kingdom having advanced from 9,121,000 tons in 1874 to 13,235,00 tons in 1888. But here, again, it is safe to say that it was not the actual profits made in the business so much as the hopes of better things to come that induced a development which, whatever its consequences may have been to the manufacturers themselves, has undoubtedly been of great value and importance to the public in general.

The present position of the coal trade is one that may be fairly regarded as satisfactory from the coal owners' point of view, except in reference to the future of labour. It is hardly to be expected that with a tendency to reduce the consumption of coal all round, the present range of prices will be long-continued, and if it should be found necessary to reduce the coal owners' profit, the wages of labour must proceed *pari passu*. So also with the profits of the middleman, which have been much larger than the public are aware of, and especially in the London coal trade. The middleman is generally safe, for the business that he carries on neither requires the capital, nor involves the risks that attend the responsible and onerous business of the coal owner. The future price of coal is, of course, a very uncertain quantity, but it is hardly likely again to reach the low level of a few years ago.—*Colliery Guardian.*

MACHINERY MECHANICS & INVENTIONS

An Improved Ventilator for Mines, Tunnels, Etc.

Knowing the keen interest that is taken by our readers in all matters appertaining to the ventilation of mines, we have much pleasure in presenting the following illustrations of the well known Champion Ventilator, or Murphy Fan, patented by Mr. F. Murphy, and manufactured by the M. C. Bullock Manufacturing Company, of Chicago, who are the exclusive proprietors of all rights regarding it. The chief merits of the fan rest upon the following points :

1st—Compactness ;

2nd—Adaptability to conditions, allowing it to be placed in the most advantageous position ;

3rd—That the current of air from the fan can be reversed at one operation as often as circumstances require it, making a blower or exhauster, as the case may be.

This may be done in a minute or two without stopping or in any way interfering with the running of the fan.

This alone is of the greatest importance, as has been proven in many cases, in keeping the hoisting shaft free from ice, clearing away blasting smoke, and, in one instance a mine fire was smothered by its assistance.

The Champion Ventilator in its original form has long been well and favorably known to the public as a most efficient and economical ventilator, having been awarded two prizes by the United States Centennial Commission, where it entered into competition with fans from all parts of the world, while numerous letters from users attest its worth.

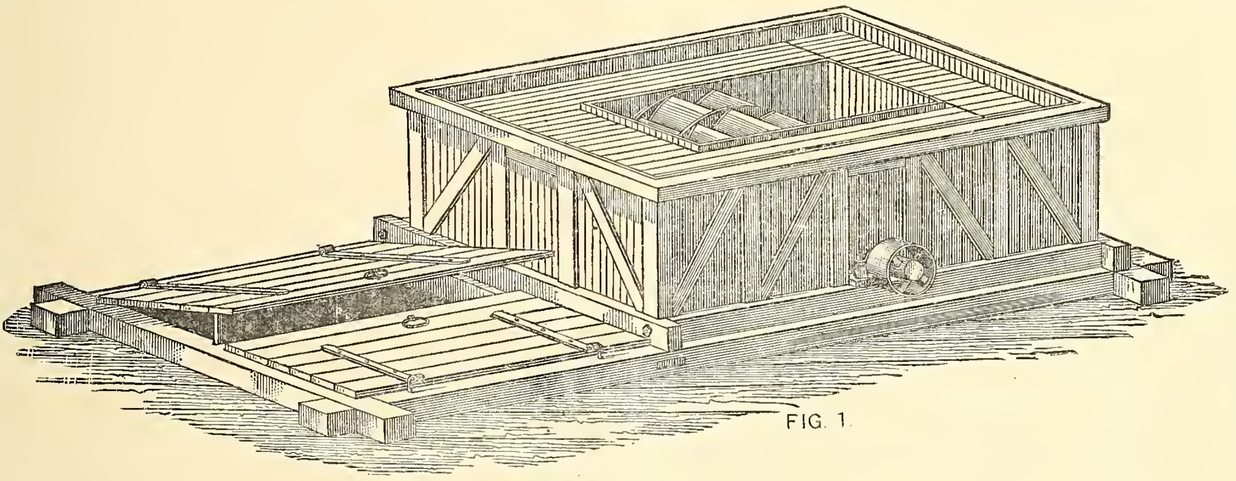


FIG. 1.

A GENERAL EXTERIOR VIEW.

There were, however, some defects inherent in that form, among them being the excessive size of the casing, the difficulty and awkwardness of manipulating eight doors every time the current was changed, the length of the shaft between bearings and consequent bending and vibration when run at high speeds; while the height of the shaft above the ground made any other connection than belting nearly impossible.

An inspection of the figures produced below will demonstrate how these defects have been overcome. The casing is reduced in size, rendering it easier to place under ground. In changing the current it is only necessary to turn the hand wheel in one or the other direction.

The shaft has been much shortened by placing the two fans side by side, forming one, and carrying the bearings inside the casing ; and in addition it has been increased in diameter, thus very much reducing, if not entirely removing all vibration, no matter at what speed the fan may be run.

Its location near the ground makes a direct connection to the engine an easy matter.

Not only has the fan been reduced in size of casing, but the shipping weight has been reduced and the efficiency increased.

With these few remarks we come to the machine under consideration.

The casing, or exterior frame, which is shown in figure 1, forms a foundation for the whole machine. Its width is about double that of the hood, and it is in the form of a box without top or bottom. The diaphragm forms an air-tight top or bottom as it is turned to either position, and blows air down, as in figure 3, when the bottom, or exhausts air from below, as in figure 4, when the top.

It is often desirable to blow the air into the mine, as in winter, blowing the cold air down the air shaft, displacing the warm and impure air, which escapes up the hoisting shaft and keeps this clear of all ice. This is accomplished by turning the hand wheel in such a direction that the hood is rotated until the opening is down, as in figures 3 and 5, and the diaphragm forming a bottom to the casing. The air then enters the casing, passing through the circular openings in the hood ; enters, then passes through the fan to the air shaft as shown by the arrows.

To reverse the current, turn the hand wheel in the opposite direction, thus turning the hood with the mouth up and the diaphragm forming the top to the box. The air from the mine and air shaft then passes through the fan, and escapes upward to the atmosphere.

Figure 2 shows the construction of the fan wheel so well as to need but little description. It is really two fans joined together by the common centre ring "g," which is a solid plate. The two outer rings have openings through them very considerably larger than usually made to admit the air to the interior of the blades, from where it passes outward, propelled by the blades, the fan running in the direction indicated by the arrow.

The blades "f" have such a curvature as to propel or lift outward the maximum amount of air with the minimum resistance and consequently minimum expenditure of power.

The radial arms "a," supporting the outer rings and blades, are wider than ordinarily made, and are set at an angle with the plane of motion. This stiffens the fan and gathers the air inward, thus obviating all pulsations of the air in the interior before it reaches the blades.

In the construction of the hood or inner casing, and the necessary modification of the casing or exterior portion, rests the chief improvement of the ventilator over the old forms.

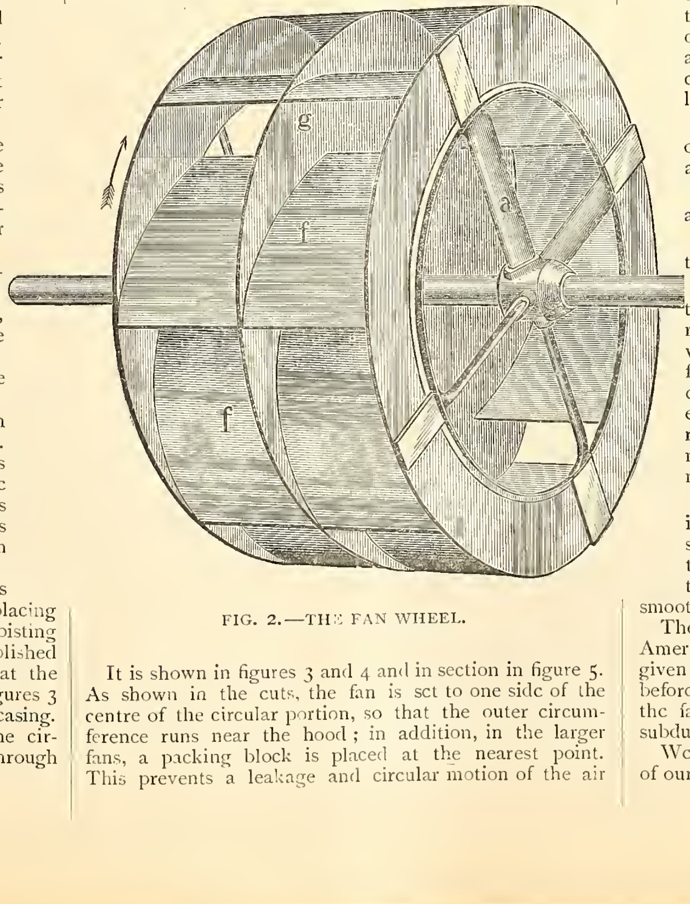


FIG. 2.—THE FAN WHEEL.

It is shown in figures 3 and 4 and in section in figure 5. As shown in the cuts, the fan is set to one side of the centre of the circular portion, so that the outer circumference runs near the hood ; in addition, in the larger fans, a packing block is placed at the nearest point. This prevents a leakage and circular motion of the air round and round in the hood. In the side of the hood are two circular openings corresponding to the openings in the fan, and again packing is put between the fan and the hood, shown by the ledge in figure 2, and the rings inside hood in figure 5.

This hood and attendant diaphragm, (shown at the sides in figure 5), are hung on bearings, whose centre corresponds with the centre of the fan shaft, and which bearings rest in brackets cast with the base of the fan shaft pillow block. Thus this hood may be revolved around the fan without stopping it, changing the current at will from blowing to exhausting.

The diaphragm coinciding in either position with ledges on the inside of the casing, forming a tight joint. This operation is accomplished by turning a hand wheel at the outside and end of the casing, shown in figures 3, 4 and 5.

Figure 4 is a sectional elevation. In this the arrangement of the various parts are shown, the machine being used to exhaust the air from the mine. The last cut depicts a vertical section through the centre of the fan, showing the internal structure, the placing of the radiating arms, supports, etc.

The ventilator may be located as shown in figures 1, 3 and 4, at the side of the air shaft and connected to it by an air-way. This leaves the top of the air shaft unobstructed in case of an accident, for the air-tight doors should be made to open outward.

In case the boilers are some distance from the shaft, it is only necessary to extend and cover, air-tight, the air-way which may be of almost any length.

In a mine operated through drifts, the ventilator may be located at the side of the opening of one and connected by an air-way and trap-doors as above. Or when desired, it may be located at the side of an underground passage, and if this passage is a roadway, separate the fan from the roadway by an air-tight partition and make in the roadway a lock of sufficient length to contain as many cars at one time as the business requires, and of course opening only one door at a time, to prevent leakages.

In a drift mine the lock may be made at the mouth of a drift, and the drift is then a roadway and air-shaft combined.

For underground work four or six-foot fans are probably the most desirable.

Full and complete erecting and locating instructions are furnished with each fan.

This ventilator is particularly adapted for ventilating all kinds of public or private buildings, removing noxious gases from chemical and other works, removing the dangerous *explosive dust* from flour mills and grain elevators, producing artificial currents in dry-kilns, etc., etc. It may be used either as an exhauster or a blower, as the case requires, and its peculiar construction insures the moving of the greatest amount of air with the minimum expenditure of power.

Particular attention is given to these ventilators in the use of the most suitable materials, the construction on a scientific and mechanical basis, and the careful balancing of the hood and fan ; everything being tested before leaving the works, and a smooth and handy-working apparatus insured.

Their utility is attested by many letters from prominent American firms, to whom, in every instance, they have given perfect satisfaction ; in one instance, as has been before mentioned, a mine fire was put out by the aid of the fan, which otherwise might have been difficult to subdue.

We commend the following tables to the consideration of our readers :—

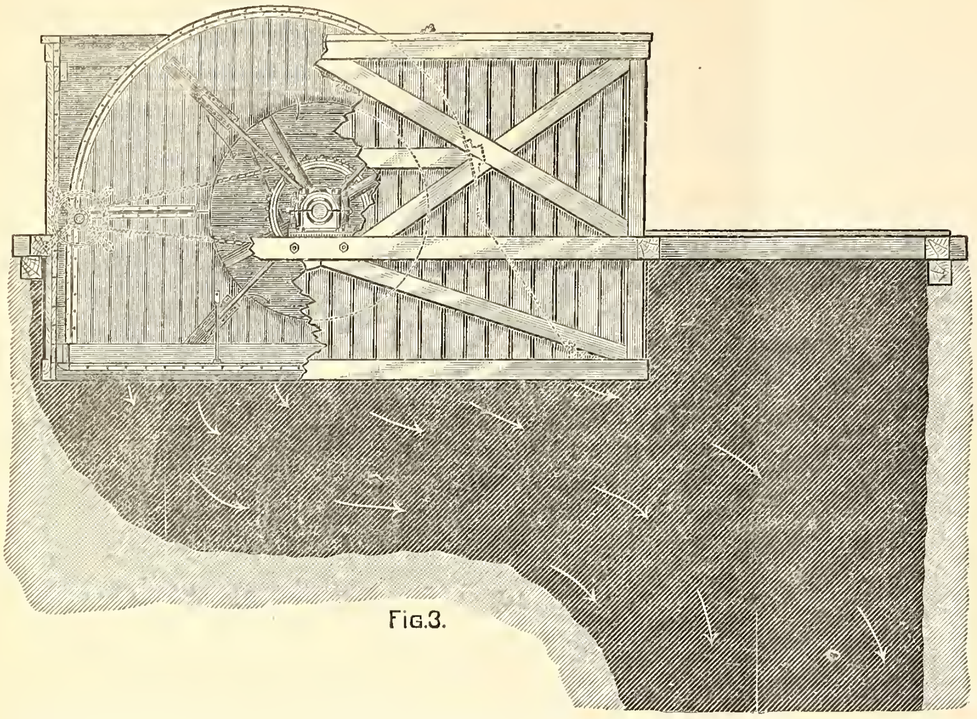


FIG.3.

SIDE ELEVATION, WITH PART OF THE SIDE REMOVED TO SHOW THE HOOD. ALSO SHOWS POSITION OF PARTS WHEN THE FAN IS A BLOWER.

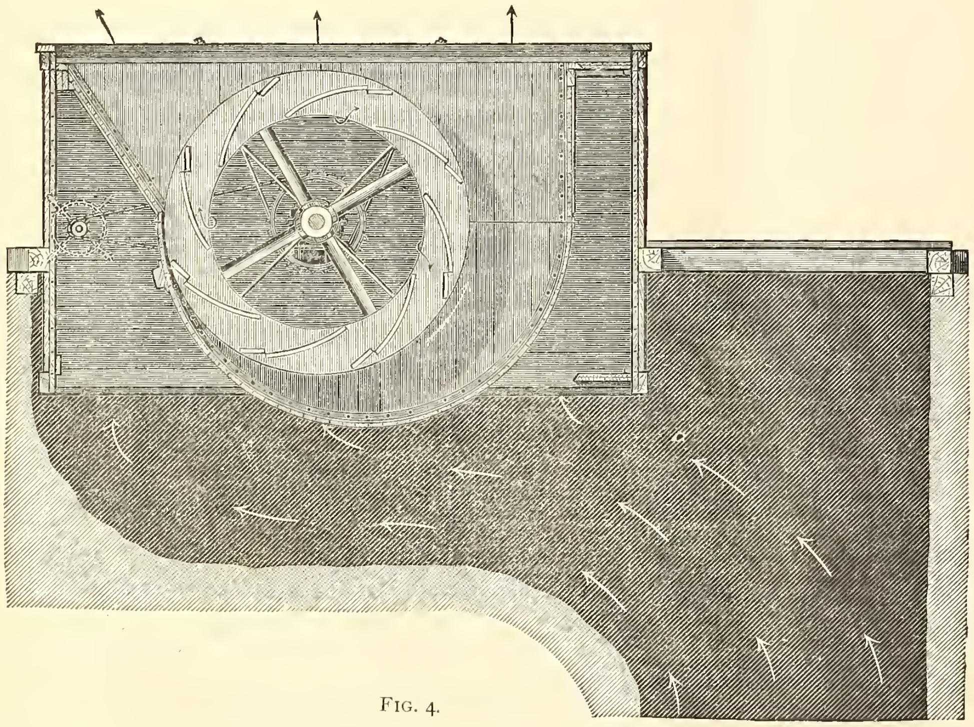


FIG. 4.

SECTIONAL ELEVATION, FAN BEING EXHAUSTER.

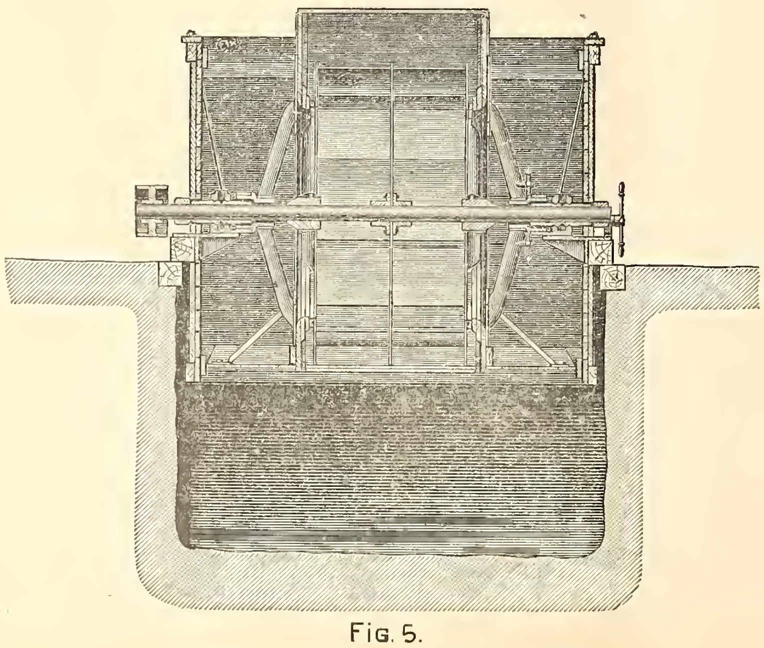


FIG. 5.

VERTICAL SECTION THROUGH CENTRE OF FAN.

TABLE OF SIX SIZES OF THE IMPROVED CHAMPION VENTILATOR.

FAN WHEEL.				OUTSIDE DIMENSIONS OF CASING.									ENGINE.			
OUTSIDE DIAMETER OF FAN WHEEL.	NO. OF REVOLUTIONS OF FAN SHAFT.	SPEED AT TIPS OF WINGS OR PERIPHERY SPEED.	UNRESISTED DISCHARGE AT GIVEN SPEED.	LENGTH.		WIDTH.		DEPTH.		HEIGHT ABOVE SUBSILL.		PROJECTION OF SILL BEYOND PANEL.	HORSE POWER.	DIAMETER OF CYLINDER.	LENGTH OF STROKE.	NUMBER OF REVOLUTIONS
IN FEET.	PER MIN.	IN FT. PER MIN	CUBIC FEET.	FT.	IN.	FT.	IN.	FT.	IN.	FT.	IN.	INCHES.	RATED.	INCHES.	INCHES.	PER MIN.
4	609	7,653	43,858	9	3¾	5	10¾	5	1⅜	3	3	4	5	5	6	280
6	406	7,653	98,683	13	11	8	6¼	7	8	4	11	4	10	7	10	190
8	305	7,665	175,435	15	10	10	8	9	2	6	0	6	16	9	12	170
10	244	7,666	274,115	19	7½	13	1½	11	6	7	6	6	24	11	13	160
12	203	7,653	394,729	23	5½	15	6½	13	9	9	0	8	31	12½	15	144
14	174	7,653	537,266	27	3½	17	11½	15	11	10	3	10	40	14	16	135

NOTE.—These engines are calculated for a steam pressure of eighty pounds to the square inch. The ventilators, when in operation at mines, buildings, etc., give in actual work from 60 to 85% of the unresisted discharge, according to the size, length and condition of the airways or flues. The unresisted discharge is the amount of air which the fan is capable of moving when the air is perfectly free to enter and leave the inlet and discharge openings, that is when disconnected with mines, buildings, etc.

Table of the Force and Velocity of Wind According to Hutton's Experiments.

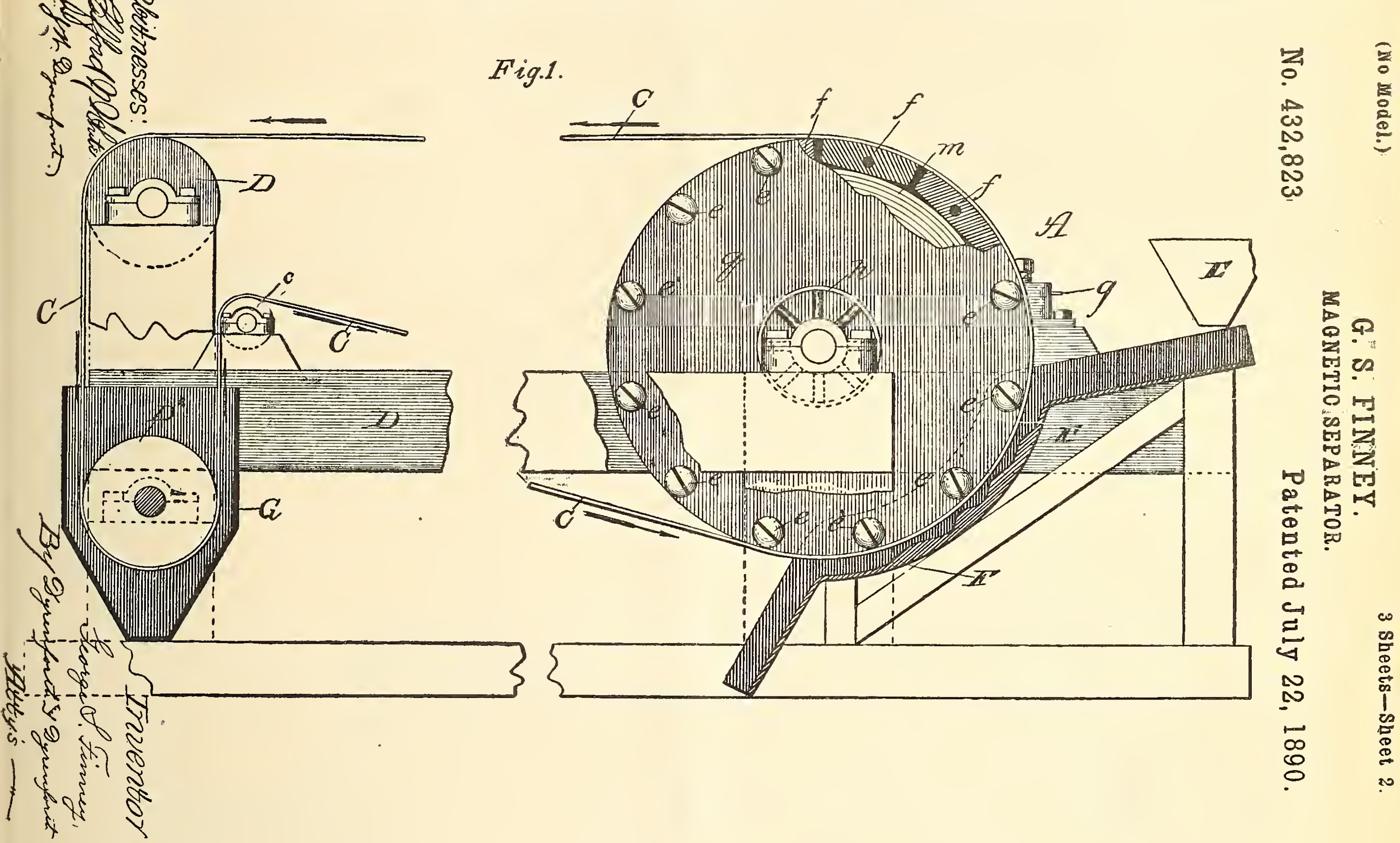
PRESSURE.		VELOCITY.		Character of the Wind according to Rouse and Lind.
In Lbs. Per Sq. Ft.	In Inches of Water.	In Feet Per Sec.	In Miles Per Hour.	
.1	.01926	7.87	5.37	Gentle Wind.
.25	.0481	12.90	8.79	Pleasant Wind.
.5	.0963	16.18	11.03	Fresh Breeze.
1	.193	24.33	16.60	Brisk Gale.
2	.385	34.17	23.30	Very Brisk Gale.
3	.578	41.69	27.77	
4	.770	48.00	32.73	
5	.963	53.55	36.51	High Wind.
6	1.155	58.55	39.92	
7	1.348	63.15	43.06	
8	1,541	67.43	45.97	
9	1.733	71.43	48.70	Very High Wind.
10	1.926	75.22	51.28	
11	2.118	75.22	53.74	
12	2.311	78.82	56.07	
13	2.504	82.20	58.32	
14	2.696	85.54	60.48	Storm or Tempest

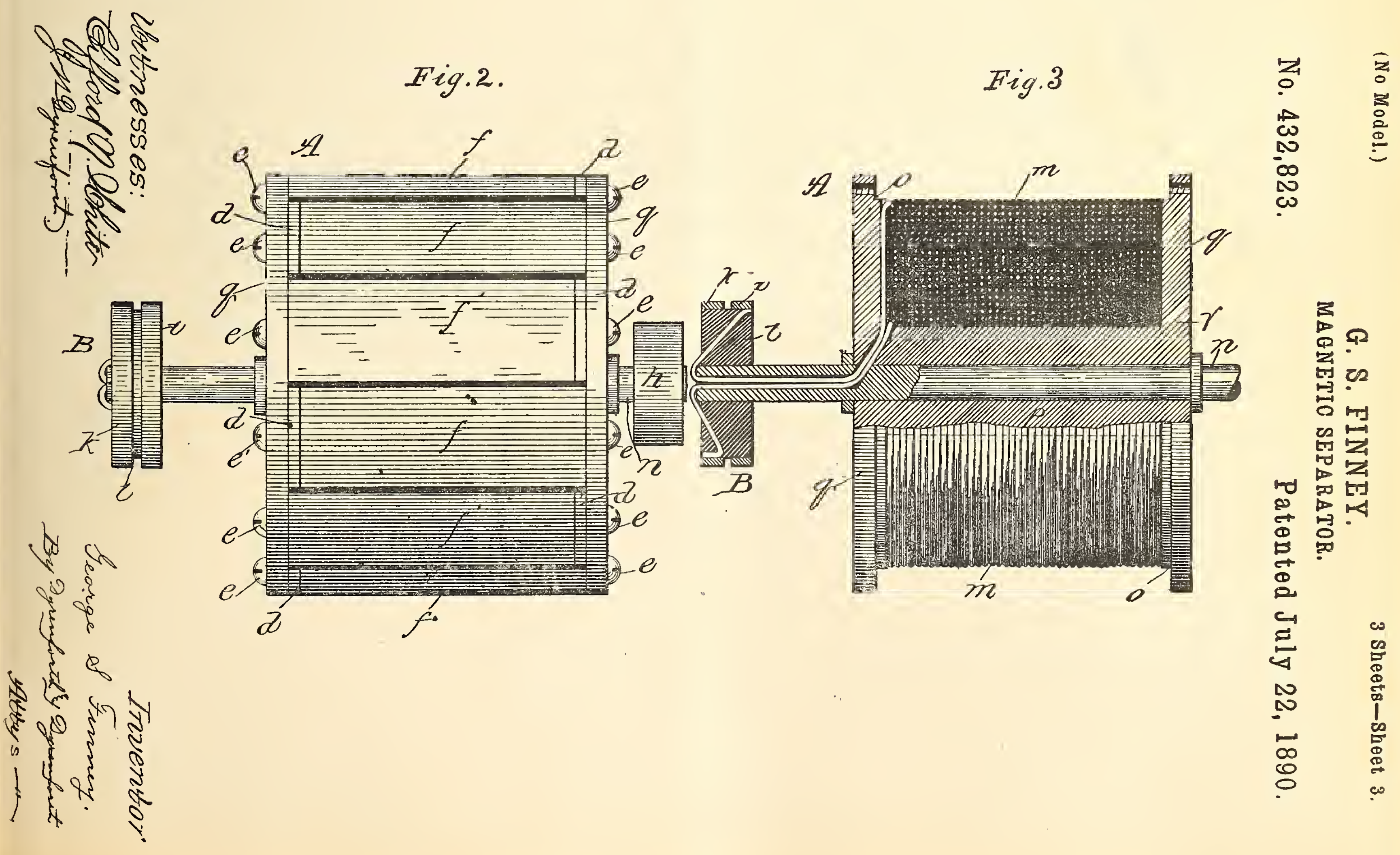
The Rotary Magnetic Separator.

The use of the magnet in separating magnetic iron from the magnetic substance with which it is mixed, is not new. An apparatus which will operate under practical conditions at a commercially possible cost is, however, a thing of recent date. Such a machine must be simple in its construction, continuous and certain in its action, and capable of handling the ore when wet. The Rotary Magnetic Separator, illustrated in the accompanying cuts, the Canadian patents for which are controlled by Erastus Wiman, fulfills all these requirements, and is expected to separate the ore at such a small cost per ton as will render available the vast beds of magnetic sand about the Lower St. Lawrence, and bring the concentrates of many low grade magnetic ores into the market. A large plant has been built at Lake Hopatcong, in the State of New Jersey, and will soon be running. Referring to the drawings, *A* is a magnetic wheel. As shown, the wheel *A* is formed of soft metal to be magnetized from an extraneous generator, and exert a magnetic influence only while the machine is in operation. Obviously, however, the wheel may be formed to retain its magnetism and thus be permanently magnetic.

The wheel *A*, as illustrated, comprises a spool, *r*, of readily-magnetizable metal, the heads, *q*, and *q1*, being of considerably greater diameter than the body portion, *p*, and being provided with off-sets, *o*, in their inner edges. The relative diametrical and longitudinal dimensions found best for its purpose are in the proportion of four to five.

The shaft, *n*, should be hollow, as shown, part way through from one end, to enable the terminals of the in-





sulated wire, m, with which the spool is wound up to the off-sets, o, to be led through it to the transmitter, B, which, as shown, comprises a disk, Z, of hard rubber on one end of the shaft and surrounded on opposite sides of the center of its periphery with metal bands, i and k, to which, respectively, the terminals of the wire, m, are connected. The opposite end of the shaft may carry the means for transmitting motion to the wheel—such as the belt-pulley, h—and current is supplied to the wheel, A, by means of brushes applied to the bands, k and i.

The heads, q and $q1$, of the spool, r, are extended by the metal bars, f and $f1$, which constitute the pole-pieces extended from the opposite ends of the spool, and are insulated from each other and caused to alternate between the heads and thus cross the plane in which the wire, m, is wound. The bars, $f1$, extend from the head or positive end, $q1$, being fitted into the respective off-set, o, where each is secured by an iron screw, e, and each bar, f, reaches short of the opposite head or negative pole-piece, $q1$, insulating pieces (brass), d, being inserted between the ends of the bars, f, and the head, $q1$, to which the said bars are secured through the insulating pieces by brass screws, $e1$. The bars, f, which alternate around the wheel with the bars, $f1$, extend from the off-set, o, in the head, q, being secured thereto by iron screws, e, and insulated from the opposite head, $q1$, by interposed pieces of insulating material (brass), $d1$, through which the bars are secured to the adjacent head, $q1$, by brass screws. It will thus be seen that the poles of the magnetic wheel are extended across its periphery, and the magnetic field is around the two lateral edges and the end of each bar, f and $f1$. These bars are preferably parallel with each other and extend parallel with the body portion, p, of the spool; but regularity in the direction of their extension is not of great importance, provided they extend crosswise (at any desired angle or angles), of the plane of the circumference of the wheel.

C is the endless apron of any suitable non-magnetic material as canvass or rubber surrounding the wheel, A, which is journalled in an appropriate frame, D, supporting a roller, $D1$, around which the apron or belt, C, is also passed.

F is a riffle-duct, and E a hopper. The wet crushed ore falls from the hopper, E, into the riffle-duct and is carried on by flow of water into contact with the magnetic wheel, A. As the ore tumbles down over the riffles in its vehicle of running water, the particles roll loosely over one another and every magnetic particle has full opportunity to obey the law of magnetic attraction and fly to the belt surrounding the magnetic wheel. The non-magnetic particles are rapidly carried away by the constantly flowing current of water. The wheel turns to the left, Fig. 1, as shown by the arrows on the belt, so that if any non-magnetic particles are mixed with the magnetic masses deposited on the belt, these particles are washed out as the mass is carried up by the wheel against the downward flowing current of water. Thus a practically pure deposit of magnetic particles is carried along on the belt over the pulley, $D1$, down into the sluice-box, G, where it is washed off and settles to the bottom. The cleaned belt returns over the pulley, $D2$, and the idler, c, to the riffle-duct to take up a new charge.

The manner of magnetizing the wheel, A, will be readily understood. The brushes (not shown), applied to the bands, i and k, are the terminals of an external electric circuit supplied from any proper source of electric energy, such as a little dynamo, and the wire, m, of the wheel, A, is thus rendered a portion of this circuit, and the whole soft iron structure of the wheel becomes a magnet. Many different forms of magnetic wheel have been devised by the inventor, and it is not yet decided which will be most generally adopted, but the principle of operation of the machine is the same with all.

What the Rotary Magnetic Ore Separator accomplishes in the shape of separation, especially in the reduction of phosphorus, is shown in the following analyses:—

LOW GRADE ORE FROM LANCASTER, PA.

	Ore.	*Concentrates.*
Iron,	19.04	71.31
Phosphorus,	9.071	0.016
Silica,	57.93	1.04
Undetermined,	15.62	0.54

LONG ISLAND SAND.

	Sand.	*Concentrates.*
Iron,	8.47	71.61
Phosphorus,	0.016	0.020
Silica,	78.04	0.60
Sulphur.	0.13	0.18

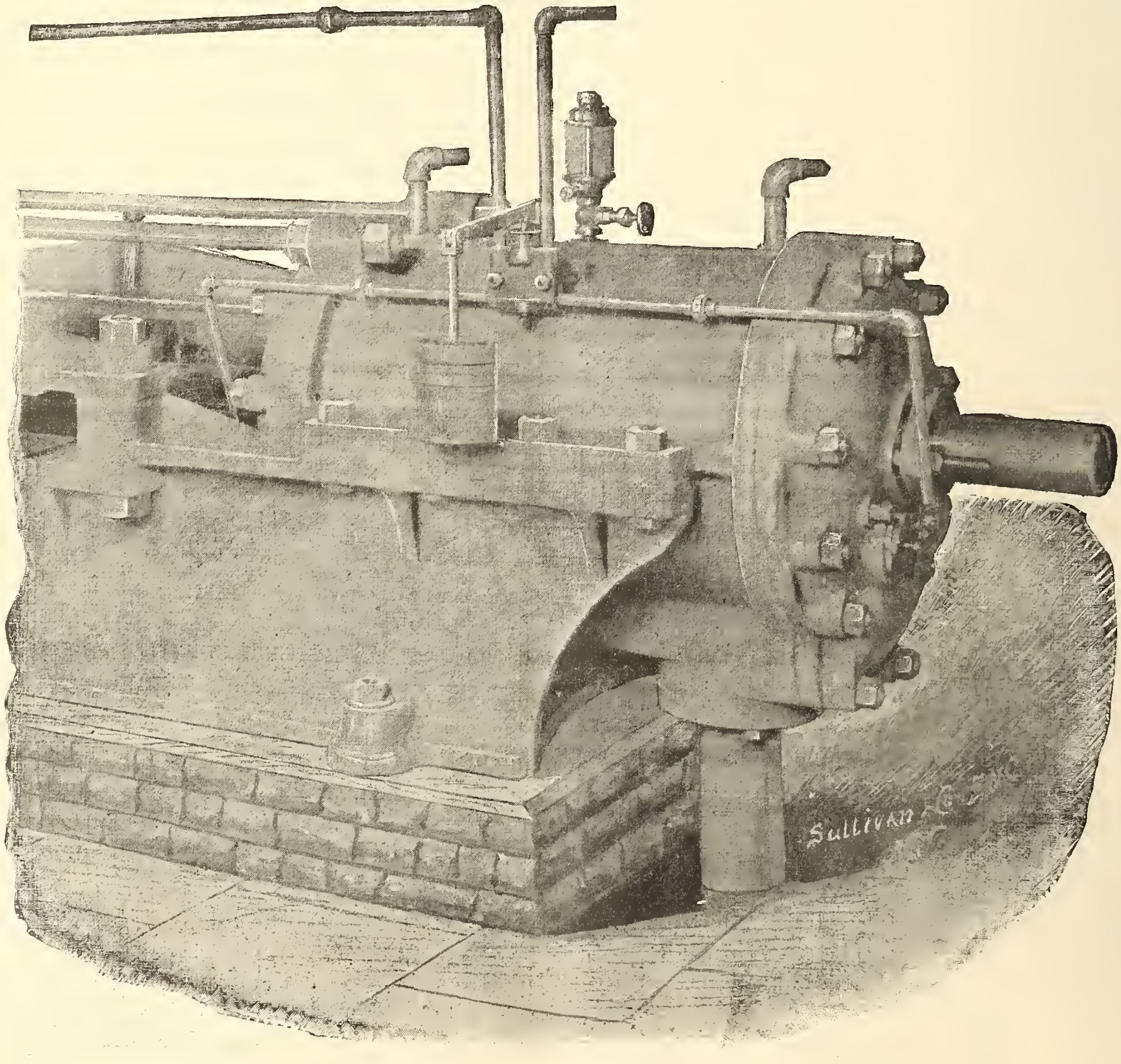
CRAB ORCHARD ORES FROM NORTH CAROLINA.

	Concentrates.	*Tailings.*
Iron,	70.22	23.56
Phosphorus,	0.016	0.036
Silica,	1.32	43.25
Sulphur,	Trace.	0.10

HECKSHER'S ORE FROM NEW JERSEY.

	Ore.	*Concentrates.*
Iron,	63.44	69.76
Phosphorus,	0.438	0.097
Silica,	7.92	1.05
Sulphur,	Trace.	Trace.

* * *



SERGEANT'S PISTON INLET COLD-AIR CYLINDER.

Recent Improvements in Canadian-Made Mining Machinery.

The Ingersoll Rock Drill Company of Canada have completed and are now occupying their new brick factory building on St. James street, Montreal.

The increasing demand for mining and quarrying machinery, has necessitated the construction of a two-story brick factory, 200 feet long, on St. James street, by 65 feet deep, directly on the Grand Trunk railway and within an eighth of a mile of the Canadian Pacific railway.

The factory has been equipped with a complete plant of new machine tools and a 30-ton travelling crane, and is lighted by an independent incandescent electric plant.

The forge department is provided with a power hammer and four large forges.

The superintendent in charge of construction is an American mechanic, whose experience was acquired in the pumping engine works of H. R. Worthington & Co., and in the New York factory of the Ingersoll-Sergeant Rock Drill Co. His ten years experience in the construction of air compressing, rock drilling and hoisting machinery, united to a large previous acquaintance with the practice of the best American shops, furnishes a sufficient guarantee of the standard of workmanship that will be maintained.

The Ingersoll Rock Drill Company of Canada is directly associated with the Ingersoll-Sergeant Drill Company of New York, and the former company has now completed arrangements for putting upon the Canadian market all the inventions and improvements in air compressing and rock drilling machinery produced for the New York company by Mr. Henry C. Sergeant, the well known inventor and pneumatic engineer.

The most important of Mr. Sergeants recent inventions, the Sergeant Rock Drill and the Piston Inlet Cold-Air Compressor, are now manufactured in all standard sizes by the Ingersoll Rock Drill Company of Canada.

Sergeant's Piston Inlet Cold-Air Compressor shown in the cut (see perspective view on back cover), posseses the following important features:—

a. The entire engine rests upon a strong cast-iron bed, and being thus self-contained cannot get out of line, it requires no expensive foundations, but if necessary can be erected with perfect safety upon a timber framework sunk in the earth.

b. The Piston Inlet Cold-Air Cylinder is a radical improvement in air compressing machinery, highly increasing the efficiency and economy of compression, at the same time greatly simplifying the construction of the compressor, dispensing, as it does, with poppet inlet valves, cages, springs and levers. It may be briefly described as follows: The air piston is hollow, and is supplied with air through the tube shown in the sectional view, which passes through the cylinder head and moves with the piston. On each face of the piston is a ring inlet valve which admits air to alternate ends of the cylinder.

c. The advantages of this construction are that cool, dry air, free from dust or grit, can be led to the tubular inlet from outside the engine room.

d. The admission of air being through a single tube, a constant draft of air *in one direction*, is created, which fills the cylinder at each stroke with air *at full atmospheric pressure.* In all other compressors the air must be started from a state of rest and put in motion through the inlet valves at each stroke, while here *it is always moving into the hollow piston.* Air having weight, this uniform movement gives momentum, *which causes the cylinder to be filled to its fullest extent at each stroke.* Indicator cards taken on these cylinders show that the cylinder is not only filled with air at atmospheric pressure, but *the pressure runs above the atmospheric line* to the same extent that it falls below in other compressors.

e. The ring inlet valves open and close by the momentum imparted to them by the movement of the piston, hence their position is almost instantaneously reversed at the reversal of the stroke. These valves admit of a *large inlet area with a small throw*, quickly opening a large supply port; thus enabling the compressor to run at high speed with full efficiency and with safety to the quick moving parts.

f. After twelve months continuous running night and day these valves, on being examined, have not shown the slightest evidence of wear.. They are practically indestructible.

g. The greater portion of the air cylinder heads in other compressors is occupied by inlet valves; the piston inlet besides dispensing with these valves admits of utilizing these spaces as cold water jackets, *presenting a cooling surface to the compressed air near the end of the stroke when it is hottest.* The moving piston continually cuts off more of the cylinder jacket, leaving at the end of the stroke but a small annular surface; by supplementing the cylinder jacket with jacketed heads, the air is kept much cooler than where the small annular jacketed surface of the cylinder is all that is relied on for cooling. Indicator cards taken on these cylinders show a pressure line *nearer the isothermal than in any other*, except perhaps those that inject water into the cylinder.

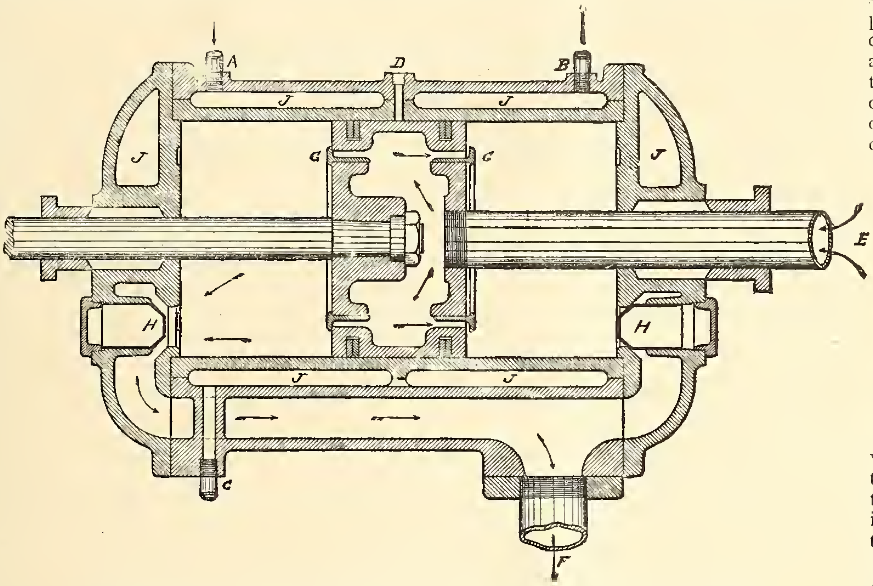
h. Clearance spaces are reduced to a minimum. There are no countersunk spaces in the air cylinder heads for inlet valves, only a single annular groove to take the face of the ring inlet valve. This groove is covered by the valve at the end of each stroke leaving no dead space.

i. The tubular inlet (shown in the cut), extending through the cylinder head, serves as a bearing and support for the piston, equalizing and reducing to a minimum the wear in the air cylinder.

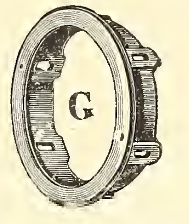
k. Sergeant's Automatic Regulator (shown in the cut attached to the side of the air cylinder), effects a material saving in steam consumption, maintains a uniform air pressure and prevents the compressor stopping on dead center. The regulator is adjusted to any desired pressure, and maintains this pressure without any attention from the engineer. If the consumption of compressed air decreases or is suddenly stopped, e.g., by the shutting off of one or more rock drills in a mine, the regulator automatically unloads the compressor without waste of compressed air, stops compression and throttles the steam supply down to a quantity just sufficient to overcome the friction of the bearings and to keep the engine in motion. As soon as compressed air is drawn from the receiver, and the pressure falls, the regulator automatically throws the load back upon the compressor and again begins compression.

l. The Improved Swivel Crosshead is provided with a vertical and lateral adjustment, so that any wear upon the crosshead guides is compensated without carrying the steam and air piston rods out of line, as is the case in other compressors. The cresshead guides have twice the bearing surface of any other compressor.

m. The large diameter of the fly wheels, and the Myers Adjustable Cut-off attached to the steam cylinder, permit an early cut-off and the highest steam economy.



SECTIONAL VIEW OF SERGEANT'S PISTON INLET COLD-AIR CYLINDER.



SERGEANT'S PISTON INLET VALVE.

◆

The Kessler Electro-Magnetic Separator.

The mines of Mercadal, in Spain, produce zinc ore (calamine) mixed with oxide of iron, and the latter is eliminated by means of the Kessler electro-magnetic separator. This apparatus is formed of a soft iron cylinder subjected to the magnetising action of a solenoid traversed by the current from a dynamo. On this cylinder circulate two endless chains guided by a wooden roller; they are formed of leather thongs joined by parallel soft iron tongues armed with numerous projecting points grouped in quincunxes. A bronze float board directs and keeps the ore on the chain which has become magnetised by contact. A counter-weight lever regulates the distance between the chain and the float board, and permits of the latter removing any obstacle which impedes the motion. The magnetic particles of ore attach themelves to the magnetised points of the chain, and are carried round till they are outside the magnetic influence of the cylinder; they then become detached and fall into a separate compartment. A rotary dog's-tooth brush placed on the plane of the axis of the roller causes the grains of iron which remained adherent to the chain to fall. According to the hold of the iron ore, the rotary speed of the cylinder can be varied from twenty to thirty-five revolutions a minute; 3·5 tons per hour can be easily treated with a motor power of one-fourth of a horse only. The production of the current (20 ampères, 20 volts) requires 2-horse power, or 2·5-horse power for the whole working of the apparatus. The cost of the Kessler separator is about £90.

◆

The Munton Process of Rolling Tires.

The most noteworthy novelty in the mechanics of metallurgy is the Munton process of rolling tires, which differs materially from any system hitherto used. It may be summarized as follows:—(1) The ingot is cast with a hole cored out large enough to admit a small roll. (2) The ingot is heated and taken to the rolling mill, where its top, with its imperfections, is sheared off and the bloom left of a given weight. At the same heat and by the same operation the bloom is also roughed out by the roughing rolls of the mill and edged down by horizontal rolls. (3) The bloom is re-heated and placed in the tire rolling mill, where it is rolled and finished to the exact inside and outside diameter required. Mr. Munton is now rolling at Melrose, near Chicago, two and three tires at one operation. The ingot is parted or "slit" in the same mill by which the tires are rolled, and at the same time. Two upright rolls are used, one roll works on the inside, the other on the outside of the tire. The outside roll is driven. It has a sharply bevelled edge as a top cutter, a projecting flange as a central cutter, and a bottom flange to support the base of the ingot. Grooves are formed in this roll at suitable places to shape partly the tread of the tires. The flanges all extend the same distance outward from the roll. The inside roll has projecting flanges to correspond with those on the outside roll, but shorter. Mr. Munton has, moreover, patented improvements on this process by which two or more tires can be slit, roughed, and finished at the same heat by using a separate finishing mill in conjunction with the slitting and roughing mill, or four tires could be finished at a single heat. A new and more powerful mill than any before construced is being made. Its entire length will be 80 ft.; its height, 44 ft.—20 ft. below and 24 ft. above the level of the ground; its width, 21 ft.; its calculated weight, 391 tons. The bed-plate will be built in six sections, with a whole length of 54 ft. 10 in. and weight of 126 tons. The inside pressure roll will be 20 in. in diameter; its weight, 12 tons. The edging roll will be 20 in. in diameter, its weight 8 tons. The power required will be furnished by a pair of compound condensing engines developing 2,000-horse power at eighty revolutions per minute, with an initial pressure of 100 lbs.; the diameter of the high-pressure cylinder is 28 in. and of the low-pressure cylinders 47 in., by 48 in. stroke. The engine shaft will be connected with the 17 in. main driving shaft, which carries a helical spur wheel of 71 in. diameter and 20 in. face, which matches on the top with a 63 in. helical spur wheel to drive the 12 in. bottom edging shaft at ninety revolutions a minute. The 71 in. spur wheel also matches into a 98 in. wheel below it to drive the 13½ in. bottom driving shaft at sixty revolutions a minute, and this shaft through a pair of mitre gear wheels of 60 in. diameter, drives the vertical exterior pressure shaft of 16½ in. diameter. The mill will rough out four tires simultaneously from the ingot, and will roll hoops up to 12 ft. in diameter.

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Building of High Pressure Boilers.

The methods employed by Messrs. Cramp in the building of large modern boilers, with thick plates for high pressures, are thus described:

The plates are, in the first place, pickled in a wooden bath containing a 5 per cent. solution of sulphuric or hydrochloric acid. After remaining in the bath for about six hours, they are removed and thoroughly scrubbed with hickory brooms, while a strong stream of fresh water is played upon them. They are then immersed in a bath of lime water to neutralize any remaining acid, and again washed with clean water. All holes are drilled, and the edges of the plates are planed and beveled for calking. The shell plating is bent cold to the proper curvature in the rolls. The flanging is done by a Tweddle hydraulic flanger, the plate being heated to a bright cherry-red. A length of about 8 ft. can be flanged at each heat. Furnace mouth plates are flanged in cast iron dies at a single heat.

After the flanging of tube plates, etc., is completed, they are reheated, and the plates are straightened on a cast iron surface plate, and finally they are annealed by cooling in the open air from a cherry-red heat.

The riveting is performed by a Tweddle hydraulic riveter, using a pressure of 1,500 lb. per square inch on the flange, which gives a stress of about 90 tons on the the rivet. The stay tubes are screwed into both tube plates and expanded, the ends in the combustion chamber being beaded over.—*Scientific American.*

The Penberthy Automatic Injector.

The Penberthy Injector Company, Detroit, Mich., have achieved a world-wide reputation, as the manufacturers of the Penberthy Automatic Injector. This injector was not known prior to 1887, and although but four years have elapsed, they report sales to date between 39,000 and 40,000. It is used on the great lakes almost exclusively, also on traction and portable engines, and in all places where there is much jar or motion, its automatic qualities being such that the feed cannot be broken so but that it will restart automatically. This feature, together with its simplicity of construction, the parts being removable without disconnecting the injector, and its entire reliability as a boiler feeder has achieved for it an enviable reputation, This firm also manufacture a jet pump that is, for its particular uses, equal to their injector; also a very decided novelty in the shape of a spring covered oil cup; a detailed description of articles manufactured by them is condensed in one of the handsomest pamphlets ever shown to the steam-using trade, and will be sent to any one interested, on application.

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The Transmission of Power by Steam.—Professor J. Herman Merivale (North of England Institute of Mining Engineers), states that since the publication of the paper by Messrs. Liddell and Merivale, the steam at Broomhill Colliery has been carried a farther distance of 120 yards, making a total of 1,414 yards, from the boiler at bank to the in-bye engine. In the meantime, the author has made numerous experiments upon the range of pipes, and has also been in communication with Mr. C. E. Emery, the managing engineer of the New York Steam Company, which has in operation several miles of pipes, supplying steam-power and heat. From the information thus obtained, an attempt has been made to draw up formulæ and tables, which, it is thought, may be of value in the design of similar installations.

The author states that the principal problems that the mining engineer has to solve in steam transmission are: (1). How many cubic feet of water must be evaporated at bank, and at what pressure, to supply the regular power to any known distance from the boiler? (2). What must be the size of the pipes through which the steam is to be conveyed, and the character and thickness of their non-conducting envelope? (3). What protections must be adopted to provide for the expansion and contraction of pipes, and the collection of water on condensation? These questions are discussed at length, and the various formulæ which may be used in solving them are set forth. The author, in concluding, states that the discussion which followed the reading of his first paper showed that an impression prevailed that transmission of power by steam to long distances—say from 1,200 to 1,500 yards—was not economical. If by this it is merely meant that there will be a loss in transmission of 30 or 40 per cent., the author agrees with this opinion; but if it is meant that transmission by steam will not compare satisfactorily with the alternative systems of ropes or compressed air, he must differ from the opinion expressed.

IRON STEEL AND HEAVY METALS.

Iron and Steel.

Montreal, February 25, 1891.—Considerable firmness has marked the course of the British pig iron market during the past few weeks. For some time business has been reduced very greatly, but buyers are now beginning to believe that the depression has passed its worst stage, and are more willing to pay existing prices, while for forward delivery advanced rates are being asked. On account of the closing down of nearly all Scotch furnaces, the leading brands such as "Coltness," "Summerlee," "Gartsherrie," "Calder," etc., have been altogether cleared out, and it will take a little time before these furnaces will be able to overtake the requirements of the founders who use these special brands. An arrangement has, however, been come to by which a few of the furnaces such as "Calder" and "Govan" are being blown in, but in face of the present high price of coal, a general resumption is considered impracticable for some time to come. Scotch manufacturers have, however, always considered the Canadian market as especially their own, and there is no doubt that they will make every effort to supply the demand for the well known brands "Summerlee," "Calder," "Carnbrae," etc., on the opening of navigation, and even to compete with American iron in Western Canada.

"Summerlee" iron is to-day, selling at $23.50 ex-store Montreal, and as it would be impossible to lay it down to sell at a lower price, it is not likely that holders will break the figure we have quoted, even for round lots. Some holders have been inclined to fear American competition, but although this prevents them, at the moment, selling their iron in Western Canada, the high rates of freight to Montreal and Eastern Ontario, will, for some time at least, ensure these markets to Scotch iron. A fair quantity of stock has moved during the past month, and as there does not appear to be too much in consumers' hands, there is no doubt that all the iron at present held in Montreal will be needed before the opening of navigation.

In Western Ontario, the American brands are still holding the market, and some of our leading stove founders are using them largely, in most cases, however, as a mixture only with the well known brands of Scotch. Even in their own markets the Americans are always glad if they can get some Scotch iron to mix with their own brands, as the result has always been a much better casting than when one iron is used alone.

It is worthy of notice that the "Canada Iron Furnace Co." of Radnor and Three Rivers are now turning out a very superior quality of charcoal iron, which is finding its way into the various foundries of Canada, not only for the manufacture of malleable castings and car wheels, where only the finest charcoal iron can be used, but also into the hands of makers of engines who require strong castings for cylinders and other special work, and for which this charcoal iron has been found extremely suitable. In strength it is far ahead of Lake Superior iron, and its results show that it can even be placed above the well-known "Salisbury" brand, which used to be considered the finest iron manufactured on this Continent. The "Canada Iron Furnace Co." intend shortly to enlarge their works so as to overtake the demand for their brand, which is at present greater than they can supply.

The leading feature of the heavy metal trade is at present the great demand for tin plates, and prices have again advanced during the past month about 50 cents per box. This is entirely on account of the increased business with the United States; and, on account of English manufacturers being fully supplied with orders, Americans are even looking round to see if they cannot pick up any odd lots in Canada. The result is that there will be a considerable scarcity of plates until the month of June, when shipments to the United States will fall off, owing to the new tariff coming into operation on July 1st. While prices of almost every other description of metals are lower than they were a year ago, the demand for this article has been such that tin plates are to-day about 25 to 30% higher than they were a year ago.

Reports from England point to a better tone in finished iron, such as bars, sheets, hoops, etc., which arises more from the unprofitable nature of the trade, however, than from any great improvement in the demand. Prices all round are stiffer than they were a few weeks ago, and in sheet iron especially, a good business has been done at somewhat advanced prices. This is true especially of galvanized corrugated sheets, in which a good business is still done with this country.

Canada plates are not being made at present, all the available power of the rolling mills being taken up for the more profitable tin plate business. As a consequence English prices are quoted very high, and it is likely that the stocks at present in Canada will fetch good figures a little later on when the demand again springs up.

The movements in copper, tin, spelter and sheet zinc, have not been very great either up or down, but it is noteworthy that the present high value of zinc will likely be maintained under the influence of the continental combination, which seems to control this article entirely.

London, England, February 15.—The general situation is probably a little weaker all around, with a good deal of uncertainty in all directions as to the near future. Warrants have been somewhat scarce for prompt settlement, but for forward lots prices are low, and, as regards hematites, quotations have dropped very appreciably. The announcement that four furnaces were being relighted at Lugar, and that others would follow, foreshadowed an important change in respect of the Scotch trade. It is now understood that about thirty of the furnaces in Scotland will be restarted in the course of the next few weeks. The men still resist the proposed reduction of 20 per cent. in wages, but it is believed that the employers will be able to obtain quite sufficient "free" labour to enable them to dispense altogether with the services of the strikers. When the furnaces have been relighted it will be seen whether they run on ordinary or on hematite and basic, the assumption being that they will mostly produce the two last named grades. In any event, the probability is that prices will fall unless the extra demand for the splint coal required for the furnaces should lead the colliers to move for a further advance in their wages. This sequel is by no means improbable. At Middlesborough matters are quiet, although the shipments to Scotland are much larger than they were a year ago. Elsewhere crude iron is dull, and stocks are understood to be growing rapidly. Several furnaces are being stopped, owing to the dearness of fuel and labour, coupled with the slow demand for pig iron. In the same way, and partly for similar reasons, some of the sheet-mills are being laid off, while in other of the finished iron and steel works the output has slackened off to an appreciable extent. Should the strike in the shipping trade become serious and spread to ports other than Cardiff, its effects upon our inward and outward seaboard traffic may be very momentous.

Scotch Pig Iron Warrant Market.—Following is a table of the pig iron warrant market, showing its position for the week ending February 10, with comparisons:—

	1891.	1890.	1889.	1888.	1887.
Scotland.					
Price of Scotch warrants, Feb. 10	46/11	52/10½	41/11	39/-	43/6
Furnaces in blast in Scotland, Feb. 10	6	90	80	84	74
Quantity of iron in public stores	561922	894424	1034367	946161	843186
Shipments of Scotch pig iron for week ending Feb. 7.	3882	6668	4118	6564	6330
Do. since beginning of year	21373	40490	48385	45231	48051
Middlesboro' iron imported at Grangemouth, week ending Feb 7	8573	3445	2331	7813	4098
Do. since beginning of year	30095	15875	43189	39434	43083
Cleveland.					
Price of Middlesbro' No. 3, warrants on Feb. 10	41/7½	52/10½	34/9	30/8	35/3
Furnaces in blast in Middlesbro' district	99	103	99	95	89
Quantity of iron in public stores*	126410	183130	252712	350025	319502
Shipments of pig iron from Middlesbro' for week ending Feb. 7	20988	11736	11332	14469	10512
Do. since beginning of year	68887	59339	90107	85123	72804
West Cumberland and North Lancashire.					
Price of hematite M/Nos. warrants	50/10	64/7½	44/11	41/8	48/4½
Furnaces in blast in W. Cumberland and N. Lancashire	43	55	49	48	50
Quantity of iron in public stores†	212168	384136	437055	423946	276000
Shipment of hematite iron for week ending Feb. 7	8045	11498	9190	10123	16018
Do. since beginning of year	38391	62870	60075	57508	58963

* Connal's & N. E. Rly. Co's.

† Workington, Maryport, and Barrow.

New York, February 23, 1891.—The iron market has been steady for some time past with little variation to note. If anything there has been some improvement, but it can by no means be regarded as permanent. A number of consumers have been in the market to replenish stocks, but the buying has been on a small scale, and has not affected prices. The lessened production of the past two months has strengthened the situation, but southern furnaces are again blowing in. Inland reports indicate on the whole a rather increased enquiry for pig iron, with slightly stiffening prices on account of the coke strike in the Connellsville district. There is much uncertainty felt in the iron market, however, as to whether this will be of long duration or not, and its effects, consequently have not yet become important. It is reported that a number of Pennsylvania furnaces have commenced to use anthracite to help out their stocks of coke.

New York dealers report a somewhat better enquiry for pig iron with larger sales. Northern brands are, however, no firmer, but there is a scarcity of Southern, and many orders cannot be filled. Dealers do not care to sell at the present range of quotations. There is much less Southern iron coming into this market now that at the same time last year, and a corresponding increase in the amount of northern. Prices are as follows:—Northern iron, No. 1x, $17.50@$18; No. 2x. $16.50@$17; Southern, No. 2x. $15.50@$16.50.

Very little has been done in spiegeleisen and ferromanganese; and only in small lots. The market has been dull for a month past, and quotations are only nominal, 20% spiegeleisen, $28@$29; 80% ferromanganese, $63.50@$64 at tidewater.

The American Pig Iron Storage Warrant Company is making steady progress. At the end of its first year it had received in store 22,900 tons of iron. During its second year, which closed about two months ago, it received 58,200 tons, making a total of 81,100 tons received, out of which there had been delivered during the second year 16,300 tons, leaving a balance on hand at the close of the second year of 64,800 tons, which are in Warrant yards located as follows: New York, 2,700 tons; New Jersey, 3,900 tons; Kentucky, 1,500 tons; Alabama, 58,700 tons.

Cleveland, O., February 24, 1891.—The position of the iron market has shown little change for some time. Pig iron has advanced slightly in price, owing to the shut down of the furnaces, but the ore market has not yet been affected. It is rumored that Gogebic hematites have been sold to Pittsburgh parties for future delivery at $1.25 per ton less than last year's price. This would make the best grades of Gogebic ores about $4.75 per ton. There have been some few enquiries and sales in small lots for immediate delivery.

Copper.—The New York market has exhibited a decidedly more lively appearance, several important contracts having been made. The main feature of the week has been the soliciting of orders for Lake Copper at 14c; and as it has become known that negotiations with the larger producers took place a few days ago in Boston, it is generally believed that this is a forerunner of the price of Lake Copper being officially reduced to 14c before long—probably from March 1. This has been anticipated by the trade for some little time, and at that figure, a good business is expected to result. The shipments of copper from the United States at the present time are heavy and exporters find difficulty in securing freight room.

The London market has been remarkably firm, and prices are reported as being decidedly better, showing an advance of about 15s in the last week. The statistics show a decrease for the first half of February of 1,000 tons; but these figures are without any charters from Chili, where the disturbances still continue. When the heavy arrivals of American copper in Europe are considered, this may be taken as a satisfactory result. On the London market Chili bars closed at £53 2s 6d to £53 5s for cash, and £53 10s to £53 12s 6d for three months prompt.

We quote: English tough £55 to £55 10s; best selected £58 to £58 10s; strong sheets, £64 to £64 5s; India sheets, £60,

The Canadian Copper Company have discharged one hundred hands, as they have ore enough for the smelter for three months. The company is now putting in new machinery that will materially change the system of reduction.

Lead.—There has not been much doing in lead in New York, and the small orders which presented themselves have been eagerly competed for. Considerable quantities have been offered for sale at about 4.30c, but without finding any buyers. It is believed that legislation will before long ensure permitting the free entry of Mexican ores. At St. Louis, there has been hardly anything doing, nominal quotations being 4.05c to 4.07½c.

There has been more firmness in the London market, which is reported at £12.10s for Spanish and £12.15s for English lead.

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Production of Pig Lead in the United States.—The production of pig lead in the United States amounted to 187,000 tons of 2,000 lbs., or a little less than in 1891. Of this quantity 53,000 tons were classed as soft lead, and 134,000 tons as refined or desilverised.

Production of Copper in the United States.—The production of copper in the United States in 1890 amounted to 278,610,000 lbs., thus far exceeding any previous record, and being 14·22 per cent. (33,034,000 lbs.) greater than the output in 1889; it now amounts to more than 50 per cent. of the world's total output of this metal in 1889. This enormous increase was made chiefly in Montana, where the Anaconda mine is officially reported as having produced 64,046,812 lbs. of copper.

The Iron Market.

The price of pig iron has been steadily declining during the past three years, until within the last three months it has reached a point nearly as low as that to which it dropped during the hard times following the panic of 1873. The conditions which prevail at the present time, however, are very different from those which were ruling then. The price of labor and nearly everything else was depressed at that time, while the present decade, aside from the disturbances which have recently been occasioned by threatening silver legislation, and the consequent financial stringency, has been one of general business prosperity.

The recent decline in the price of iron is evidently due, then, to entirely different causes than those which affected the market fifteen years ago.

A general impression seems to prevail in the iron trade, at the present time, that prices have practically reached the bottom point, but with a situation of affairs such as exists we much fear that this may not be the case, and, in any event, it would be idle to look for any increase for months to come. At the close of 1890 there were unsold stocks of pig iron in warrant yards and makers' hands to the amount of 741,281 net tons. The consumption of iron during the year 1890 had been exceptionally large, but the production had been larger notwithstanding the fact that a number of furnaces in the Birmingham district of Alabama had been out of blast during the last quarter of the year on account of a strike of miners and furnacemen. The Lake Superior mines had increased their production in a reckless manner, and at the close of the year there were certainly more than 1,200,000 tons unsold at Lake Erie ports.

With the month of January, production was largely decreased, and a number of furnaces in the Mahoning and Shenango Valleys blew out. The market price of iron had fallen to very near and in some cases quite down to, the cost of production in these places, and it was necessary that the iron masters should take steps toward a readjustment of schedules, obtaining reductions in the price of ore, coke, lime-stone-freight rates, etc. Failing in this, the closing down was determined and 10,000 men were thrown out of employment.

It was not only the furnacemen of Ohio who were feeling the effects of the condition of the market so keenly. Iron works and rolling mills all over Pennsylvania were obliged to make reductions in wages, as was the case also in the Connellsville coke region which has resulted in a strike of immense proportions. In the Lake Superior iron-ore mines, wages have been very heavily reduced, in some cases as much as 20 to 25 per cent., and the cost of ore will be greatly reduced this year.

The fundamental cause of the existing situation has been the competition of the Southern furnaces. A large number of these, erected solely to form the nucleus of a town site boom, having fallen into difficulty during the financial stringency of the past months, have been pouring iron into Northern markets at almost any price, in order to raise money to meet their obligations. As we are reliably informed, several important lots of Southern gray forge iron have been sold, at the furnace, at a price as low as $9 per ton. There is no competition as severe as that of a bankrupt concern, and some of the Southern furnaces are certainly not strong financially.

It will not be until business again becomes settled and production resumes its natural course that the price of pig iron is likely to become firm again. With the capacity for production so much greater than present consumption, with ore, coke, transportation, and wages declining, and furnaces blowing in there is not much probability that prices will permanently go much higher, and the prospects are that temporarily they may go lower than they have been.

Notwithstanding these circumstances, however, the rolling mills have seen fit to increase the price of steel rails, and for these, which two months ago could be purchased for $28, they now demand $30. The officers of the steel companies deny that a combination has been effected between them, but only an arrangement to regulate output and prices. In other words, it is a trust in all but name and organization. We shall watch with interest this attempt to control market prices in defiance of all natural conditions.—*Engineering and Mining Journal.*

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French Metallurgical Trade.—The detailed statistics of French metallurgical trade during 1890 show that the total imports of pig iron, finished iron, and steel amounted during the year to 214,489 tons, an increase of 19,724 tons over 1889. The exports reached 307,490 tons, a growth of 65,609 tons on the twelvemonth. Of this increase 51,240 tons was due to pig iron, of which the total shipments where 171,243 tons. The finished iron exports, 66,639 tons, show a reduction of 1,000 tons, while steel was exported to the extent of 42,315 tons, a rise of 6,000 tons. The imports of iron-making minerals in the same period reached 1,609,423 tons, an increase of 167,000 tons, while the exports, 285,366 tons, increased by 23,500 tons. The imports of coal and coke into France during 1890 amounted to 10,371,289 tons, or 1,411,072 in excess of the figures for 1889.

The German pig-iron production of the Saar and Lothringen furnaces in 1890 amounted to 1,012,030 tons, as against 899,924 tons in 1889. Of this quantity, 568,187 tons were puddling pig; 331,003 tons, Thomas iron; and 112,839 tons, foundry pig. In the Saar district two new furnaces are nearly ready for work, one having been built by the Burbacher Company and the other by the Völkinger Works.

American Metals and Minerals in 1890.—The returns of the metal and mineral production of the United States in 1890, show a remarkable increase in almost every particular. The output of pig iron, coal, iron ores, copper, lead, gold and silver were all in excess of the previous year. In coal, one of the most important, the relative figures of 1888 and 1889 were:—

	1888. — Tons.	1889. — Tons.
Bituminous coal	78,740,000	91,107,000
Anthracite	37,578,000	41,625,000
Totals	116,318,000	132,732,000

An increase of nearly 16½ millions of tons in a single year, and one which has never been approached by any European country. The States which contributed principally to these returns were the following:—

	1888. — 1 = 1,000 Tons.	1889. — 1 = 1,000 Tons.
Pennsylvania	30,866	33,796
Illinois	10,279	14,655
West Virginia	4,837	5,499
Alabama	1,950	2,900
Iowa	4,474	4,952

The colliery consumption of the United States is returned as amounting to 6,622,000 tons in the latter, as compared with 5,960,000 tons in the former year. Of the total output of the year 1889, about 61 millions of tons were furnished by the Appalachian, 11,842,000 by the western, and 19,173,000 tons by the central groups of States.

The returns of 1890 will, as far as can be judged, show as great an increase over 1889, as 1889 over 1888. The consumption is certain to be largely augmented by the diminished supply of natural gas and the consequent necessity too employ solid fuel in place of that special fuel hitherto so largely used at Pittsburgh and other places, while in the south, the production is being stimulated to the greatest possible extent.

Iron ores show the same features as coal. Available statistics as to the output of iron ores will probably show that in 1890 the United States have produced some 17 million tons of this mineral. All that is at present known with certainty is that the Lake Superior region has produced a total of 8,143,000 tons, which is under the quantitp anticipated some time ago. The various ranges have produced as possible:—

Marquette	2,643,700 tons.
Menominee	2,163,000 "
Gogebic	2,460,000 "
Vermilion	878,700 "

Besides the large quantities of iron ore raised, there was a very large import into the United States in 1890, the total quantity received from outside sources being estimated at about 2,800,000 net tons. The principal sources of supply were the Spanish mines of Carthagena and Bilbao, and the mines of the Pennsylvania Iron Company in Cuba. The latter company has recently put down a fine plant near Baltimore, for the purpose of smelting the Cuban ores, which they receive through Chesapeake Bay. The Bethlehem Iron Company likewise largely depend on imported ores, chiefly from Spain. It is believed that in some of the principal mining localities of the United States, and especially in the Lake Superior region, the output of ore has recently been largely in excess of actual demand, and this view is confirmed by returns of shipments at Lake Erie ports in 1890, which amounted to only 5,588,000 tons, or 1,286,000 less than the quantities of ore received at these ports from the Superior mines. Evidently there is no likelihood of a scarcity in ore supplies.

The estimate of the output of pig iron in the United States in 1890 is placed at fully 9,750,000 net tons of 2,000 lbs., the make for the census year ending June 30th last having been 9,579,000 tons. Of the latter quantity the principal items of increase as compared with the make ascertained for the census year 1880, were as under:

	Output in 1880. 1 – 1,000 tons.	Output in 1890. 1 = 1,000 tons.	Increase in 1890. 1 = 1,000 tons.
Pennsylvania	1,930	4,713	2,782
Ohio	549	1,302	753
Alabama	62	890	828
Illinois	95	674	579
New York	313	359	46
Virginia	18	302	284
Tennessee	48	291	242

Washington and North Carolina, which produced no pig iron in 1880, entered the ranks of the pig iron making states in 1890, but in the more remote states, such as Texas, Oregon, Indiana, and Colorado, there has been no material increase as between the two years.

The total production of steel of all kinds in the United States for the census year 1890 was 4,467,000, and of steel rails, 2,036,000 net tons, so that the production of steel rails is not now one-half of the total quantity of steel turned out.

In 1885 there was only a difference of 838,000 tons between the production of steel and the make of steel rails, whereas in 1890, the difference is estimated at not less than 2,700,000 tons, all of which will be worked up into other forms and descriptions of finished material. The rail business of the United States is now in the hands of seven companies, of whom the Illinois Company, with four plants, have the largest capacity, about 925,000 tons per annum—the next being Messrs. Carnegie Brothers, with two plants and a total annual capacity of over 600,000 tons. During the current year the new plant of the Pennsylvania Steel Company will be put in operation, and the united rail mill capacity of the seven companies then manufacturing will be about 3,000,000 tons, or 800,000 tons more than the estimated demand for rails during 1890, and more than three times the total annual output of steel rails in the United Kingdom.

The imports of iron and steel into the United States during 1890, appear to have been considerably less than in the previous year, which is only what might have been expected, considering the disturbing influence of the McKinley tariff and other troubles. The principal imports for the ten months ending October 31, were:

		1889. 1 = 1,000.	1890. 1 = 1,000.
Tin plates	lb.	640,812	614,443
Steel plates, &c	lb.	13,103	16,210
Ingots, blooms, &c	lb.	151,148	54,062
Hoop, band and scroll iron	lb.	28,117	13,538
Cotton ties, &c	lb.	44,774	33,769
Bar iron	lb.	52,605	47,006
Pig iron	tons	130	119
Scrap iron	tons	30	42
Wire rods	lb.	138,879	108,998

The exports of iron and steel from the United States are not very considerable, and they vary much less than the imports, which are accustomed to make unexpected leaps. The total exports of 1889 are shown in the following table, the year 1880 being also given for purposes of comparison.

Value of the Exports of Iron and Steel from United States.

	1880. 1 = 1,000 dols.	1889. 1 = 1,000 dols.
Pig iron	54	229
Band, hoop and scroll	23	1
Bar iron	25	48
Car wheels	86	74
Castings	222	370
Cutlery	71	102
Firearms	2,286	820
Ingots, bars and rods	15	23
Cocks, hinges, &c	—	1,700
Machinery	3,490	7,166
Nails and spikes	287	448
Printing presses	251	223
Rails of iron	33	—
Rails of steel	14	236
Saws and tools	958	1,980
Scales and balances	199	301
Sewing machines	1,649	2,248
Fire engines	11	10
Locomotive engines	466	1,227
Stationary engines	136	133
Boilers	104	267
Stoves and ranges	91	273
Wire	—	594
Other manufactures	4,240	—
Totals	14,716	21,156

It will thus be seen that the iron trade of the United States is making some headway in reference to exports, but not to any large extent. Indeed the value of the imports of tin plates alone, will considerably exceed the value of the exports of all descriptions of iron and steel from that country. American iron and steel find hardly any market in Europe, but are being used in constantly increasing quantities in the South and Central American States.

Pig Tin and Tin Plates.—Below are given statistics of the sources of production of pig tin and the relative consumption of tin plates by various countries:—

PRESENT SOURCE OF PIG TIN.

	Pei annum. Tons.
Great Britain	9,200
Australia	6,500
Straits (Eqatorial 100°—102° Long)	28,000
All other sources (U.S. none)	12,800
Total	56,500
Consumption of such (ex-plating):	
United Staties	16,000
Europe	8,000
Other countries	6,000
On hand and afloat	4,000
Total pig tin used	34,000
Total used in plating	22,500
Producing of tin plate	625,000
Of which the United States uses	410,000
Great Britain	67,000
All other countries	128,000
Such plate is approximately ....95% iron	
" " " .... 5% tin	
Thus there is imported into the U. S., tin	37,500
" " " " iron	372,500
Having, approximately, a value pig tin	$ 8,000.000
" " " tin plate	26,000,000
	$34,000,000

that is annually contributed abroad by United States.

American Pig Iron Surplus.—The stocks of pig iron on hand and unsold, December 31, 1890, were the largest known in the history of the American iron trade. According to the official figures of the American Iron and Steel Association, the unsold stocks on hand at the date mentioned were 681,992 tons, as compared with 389.244 tons June 30, 1890, and 277,401 tons December 31, 1889. The detailed figures are given below :—

	Tons of 2,000 lbs.		
States.	Dec. 31, 1889.	June 30, 1890.	Dec. 31, 1890.
New England	19,897	15,344	11,572
New York	42,607	38,323	64,381
New Jersey	5,800	500	25,078
Pennsylvania	67,005	135,303	204,535
Maryland	1,372	1,890	1,637
Virginia, N. Carolina, Georgia, and Texas	8,130	19,149	28,707
Alabama	39,916	58,717	69,957
West Virginia	......	1,080	11,414
Kentucky	5,382	8,176	9,413
Tennessee	7,982	11,089	28,142
Ohio	27,579	46,192	116,608
Michigan and Indiana	25,102	18,339	56,452
Illinois	......	.....	19,504
Wisconsin	9,428	14,424	
Missouri and Colorado	8,881	13,424	29,434
Pacific States	8,220	7,304	5,168
	277,401	389,244	681,992

At the end of last year there were 311 furnaces in blast and 251 out, while at the same time in 1889, 344 were in blast and 226 out.

A New Method for Testing the Hardness of Metals.—C. A. Caspersson, Margretshill, Sweden, has recently obtained a patent for a method of testing the hardness of iron and steel while in process of manufacture. The inventor conducts a current of electricity through a test piece of iron or steel, melting the same, upon which the strength of the current necessitated in the operation is compared with the strength of current required for the fusion of a standard piece of metal of determined degree of hardness, and of the same diameter as the piece to be tested. The hardest piece will resist longest, but melt if the current be maintained sufficiently long. It is thereby easy to ascertain the hardness of any metal treated, through the number of ampères required in its fusion.

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English vs. American Files.

From actual experience of various files, Mr. Henry Binsse, proprietor of the Newark, N.J., Machine-tool Works, has come to the conclusion that those of American make are very much inferior to English or Swiss files. The fact was first brought prominently before him by the smoothing of a hardened steel die. Three American files were used one after another, but had no effect ; but a Swiss file being afterwards used, the work was rapidly performed, and the tool was worked with for six months afterwards. Mr. Binsse therefore looked into the whole question carefully and satisfied himself that, while the coarser American files, from ten inches in length upward, will bear comparison with foreign makes, the rest of the list cannot be compared with similar English, French or Swiss files. He says the American file-makers, finding their smaller sizes "simply trash," secured a prohibitory tariff upon imported files, and soon had the market practically in their own hands. He asserts that the profit on the foreign article is much smaller than on the American, so that merchants perfer to sell the latter, and thus, "little by little, we have accustomed ourselves to the inferior article and a decreased output." Mr. Binsse is convinced that every machinist, locksmith, die-maker, tool-maker, instrument-maker, and watchmaker using files of the inferior American make finds his product thereby diminished about one-half and his profits correspondingly lessened. American manufacturers have of course come forward to defend the home article, and one alleges a want of skill on the part of Mr. Binsse and his foreman ; another suggests that he may not have used the *best* American files, whereas he evidently used the best foreign ones ; while a third firm, who are also importers, content themselves with saying that Mr. Binsse's statements are somewhat overdrawn. They admit that English files are the best made, but claim that the American article is improving rapidly. They remark, further, "as to the tariff—as manufacturers we like it as it is, but as importers, of course it should be repealed. At any rate, we think no one would be harmed, but everyone benefited, if the tariff on files were slightly reduced. The manufacturers here were not so highly protected while they were learning to walk, and none of them act now as though they needed crutches. The McKinley Bill does not increase the duty on files, but makes a deduction of 25c. per dozen on the larger sizes, which are seldom if ever imported. Perhaps Mr. Binsse has come across a package of files that by some error were never tempered, or else he has not yet tried any of the leading American brands. If he will communicate to us his address we will send him samples of American-made files that we claim are good." From all of which it may be inferred that the American users of files are being made to pay high prices for many grades of poor-quality files, and that the import duties are most effective upon exactly those grades.

◆

The Equipment of a Great Steel Works.

A blast-furnace plant which can produce 2,000 tons of pig iron per day is, of itself, a marvel, and yet it only forms a portion of one large American steel rail producing plant. The Edgar Thomson Steel Works at Bessemer, Pa., has a capacity of the above amount, but it is seldom that all the furnaces are operating simultaneously. Recently, however, the average daily output of the pig metal from the plant has been 550 tons, as set forth in a very interesting and beautifully prepared description of the works, issued as a souvenir of the late visit of the European engineers to the United States. This monograph also states that the largest output any one furnace reached in a day was 457 gross tons, the greatest product of one furnace in a week being 2,462 gross tons, and in a month one of the stacks produced 10,164 gross tons. Most of this metal is tapped into ladles and carried direct to the Bessemer convertors, the output of Sunday only being cast into chills. These ladles, which each hold 10 tons, are conveyed over a standard-guage railroad to two "mixers," each having a capacity of 100 tons, and in these the tappings from the various furnaces are thoroughly mixed so as to produce a uniform quality of metal.

The following tabulated statement gives the dimensions of the furnaces forming the plant, the number and size of the fire-brick stoves connected with them, and a statement is also made of the equipment for producing steam and generating blast :—

Stack.		Height.	Bosh.	Stoves.
Furnace	A	65′	15′	4 stoves 65′ x 15′
"	B	80′	20′	4 " 75′ x 20′
"	C	80′	20′	2 " 75′ x 20′ 2 " 75′ x 21′
"	D	80′	23′	6 " 78′ 6″ x 21′
"	E	80′	23′	1 " 78′ x 20′
"	F	80′	22′	7 " 78′ 6″ x 21′
"	G	80′	22′	
"	H	90′	22′	7 " 78′ 6″ x 21′
"	I	90′	22′	

Total, 9 furnaces ; 33 stoves.

To supply blast to these furnaces, 26 vertical blowing engines, all of which have blowing cylinders 7 feet in diameter, are in use. The strokes of eleven of these are 5 feet, and of fifteen, four feet. The diameters of the steam cylinders are as follows : Two of 32 inches, thirteen of 35 inches, and eleven of 40 inches. Steam for these furnaces is generated in 116 boilers, and the equipment is being increased by the construction of 32 additional ones. Of these boilers, 64 now in use and 32 which are building, are 54 inches in diameter, 28 feet long with two 18-inch flues.

The balance of the boilers being double tier in construction, 28 have upper boilers 50 inches in diameter and 54½ feet long, lower boilers 40 inches in diameter and 44 feet long. Sixteen are nearly the same length; but in twelve of these the diameter of the upper boilers is 42 inches, and of the lower boilers, 32 inches; and four have upper boilers 36 inches in diameter and lower boilers 28 inches in diameter. The remaining eight boilers of the equipment have upper boilers 48 inches in diameter by 32 feet long; lower boilers, 36 inches in diameter by 21½ feet long.

In the steel department are four 10-ton convertors, to which the molten pig iron is taken from the mixers, thus obviating the use of cupolas, although there are five in the building for emergencies. The convertors are blown by three vertical engines with 42″ steam cylinders, 54″ air cylinders and 48″ stroke; one vertical double engine with 36″ steam cylinders, 54″ air cylinders and 48″ stroke. Four No. 7 blowers are in place for the cupolas. Instead of being stripped in the pits, the ingots are pushed out of the moulds by means of two hydraulic ingot pushers. The ingots are re-heated in nine furnaces using natural gas as a fuel.

The blooming mill consists of a three-high 36″ blooming train and table, which are driven respectively by a 36″ x 72″ and a double 9″ x 12″ engine, a shear, shear-engine 14″ x 24″; also a 3-ton hammer. From the hammer the blooms are carried by a series of driven rollers to a switch, which distributes them to a car running to the five re-heating furnaces. From there the blooms are carried to a three-high 24″ rail train, then to a three-high second roughing train, and, finally, to a two-high finishing train of 24″ rolls. The first and second train are run by two 46″ x 60″, and the third by a 30″ x 48″ engine. The mill is also equipped with hot saws operated by a 16″ x 21″ engine and two hot beds.

The finishing department contains the two cold beds, eight straightening and eight drill presses. The daily output of finished rails has averaged 1,075 tons, sufficient to lay ten miles of single track, the best record being 1,417 tons per day, 7,222 tons per week, 30,005 tons per month.

Steam for the steel department is furnished by ninety boilers, seventy of which are finished and twenty building.

32	are	28′	long,	54″	diameter,	with	two	flues.
4	“	28′	“	48″	“	“	“	“
8	“	28′	“	48″	“	“	four	“
44	“	28′	“	54″	“	“	two 16″	“

Two Heine boilers, 16′ long, two flues, 30″ diameter, with one hundred and thirteen tubes, 3½″ in diameter.

Twenty-five million gallons of water are used per day, 19 pumps supplying the steel department and 24 the blast furnace plants. Light is furnished by three Brush 65-light dynamos, driven by three 11″ x 22″ Buckeye engines running 175 arc lights.

◆

Copper Depositing Process.

Several English trade papers published accounts of a recent inspection of the works, at Leeds, in which the Elmore copper depositing process is in operation. It is stated that wire produced by the process, being drawn directly from the electrolytically deposited copper without melting, thereby ensuring the maximum purity and the maximum conductivity obtainable in copper, possesses a uniform conductivity of over 102 per cent., and can be drawn down to the very finest wire without any annealing at all ; whilst, with a breaking strain of 29 tons per square inch, the elongation is only ¾ per cent. The method of manufacturing wire by the Elmore patents also eliminates the necessity of many of the steps involved in the production of this article by the older processes.

The first process inspected was that of melting down the Chili bars, which contain a small percentage of alloy, including gold and silver, which are recovered after purification. The molten metal is poured into a cold water tank, by which method it is converted into a convenient form for introduction into the tanks. The generating-room contains at present three dynamos for generating the electric current, which is carried into the depositing sheds, where the real manufacture is conducted. This shed contains sixty tanks, through all of which the electric current passes. The tanks are filled with a solution of copper sulphate and sulphuric acid, and the mandrels slowly revolve in them.

The current causes pure copper to be deposited on the surface of the mandrel, and burnisher, which is simply a piece of agate, passes slowly up and down. leveling the deposit. The time required for depositing a uniform coat of ⅛ inch thickness is a week. In an adjoining shed the process of removing the tubes from the mandrels by means of rolling is carried on. There are also in progress on the estate large works of wire-making. After inspecting the process of manufacture, the testing-room was visited, where experiments were made to show the great strength and high qualities of the copper produced. The result of an experiment showed that the piece tested possessed tensile strength of 20·9 tons to the square inch. The elengation was 21 per cent. in 10 inches.

◆

English Export of Tinplates.—The exports of tinplates from the Bristol Channel ports to the United States and Canada for the month ending January 31, were as under : To Portland (Maine), 9,020 boxes ; New York, 105,278 ; Baltimore, 115,681 ; Philadelphia, 42,379 ; New Orleans, 19,984 ; and to San Francisco, 6,299.

◆

Messrs. Butterfield & Co., manufacturers of taps and dies, are about to move into a new factory, of a size suitable to the constantly growing requirements of their business. This firm which started in a small way in 1879, has met with such success that latterly they have been obliged to use a portion of their machinery constantly overtime in order to fill their orders. They have issued an 80 page catalogue which presents a number of new features, and will be found of interest to the trade.

FIRE FELT is a new Non-Conducting material, made into sections to fit any size of pipe, and into rolls and sheets for large surfaces. It is a flexible felt-like fabric, **made of pure Asbestos.** It has been demonstrated by the United States Navy and others to be superior to hair felt as a non-conductor, and is **indestructible by heat. Covering your Steam or Hot Air Pipes will save from 10 to 40 per cent. in fuel and give dry steam at long distances.**

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Mr. J. R. Gordon, C.E., who spent most of the season of 1890 investigating the nickel deposits in the vicinity of Straight Lake, a station on the main line of the Canadian Pacific Railway, about 47 miles west of Sudbury, reports very favorably of these properties. The deposits extend from about one mile north-east of the railway to about four miles southwest. Where the lode crosses the track in the Township of Moncrieff, the vein or deposit of nickel is nearly 20 feet wide. The vein varies in width from 10 to 20 feet, but in places is over 30 feet wide. At the western terminus of the lode in the Township of Craig, which is immediately west of the Township of Moncrieff, the width increases. The last showing is about 1½ miles from the Spanish River.

The Huronian rocks have been traced by Dr. Robert Bell, of the Geological Survey of Canada, for a distance of some three miles west of the Spanish River, and to South and West are gneiss formations.

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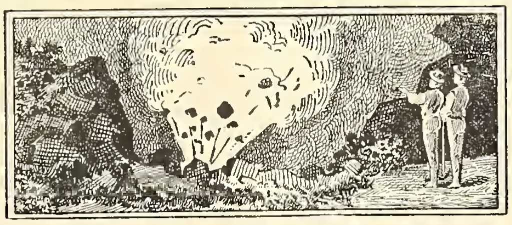

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No tender will be received unless made on such printed forms. Patterns of articles may be seen at the office of the undersigned.

Each tender must be accompanied by an accepted Canadian bank cheque for an amount equal to ten per cent. of the total value of the articles tendered for, which will be forfeited if the party decline to enter into contract when called upon to do so, or if he fail to supply the articles contracted for. If the tender be not accepted the cheque will be returned.

No payment will be made to newspapers inserting this advertisement without authority having been first obteined.

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Comptroller N.W.M. Police.

Ottawa, Feb. 9th, 1891.

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" 20, " " 40	20c.
" 40, " " 60	30c.
" 60, " " 80	40c.
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If not exceeding $10	10c.
Over $10 not exceeding $20	20c.
" 20 " " 30	30c.
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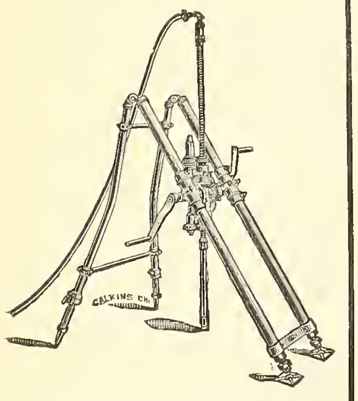

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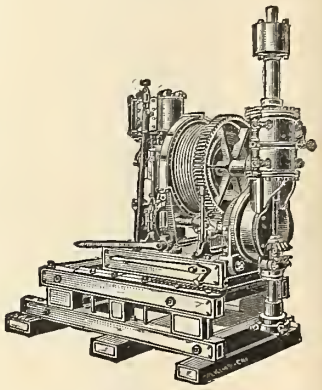

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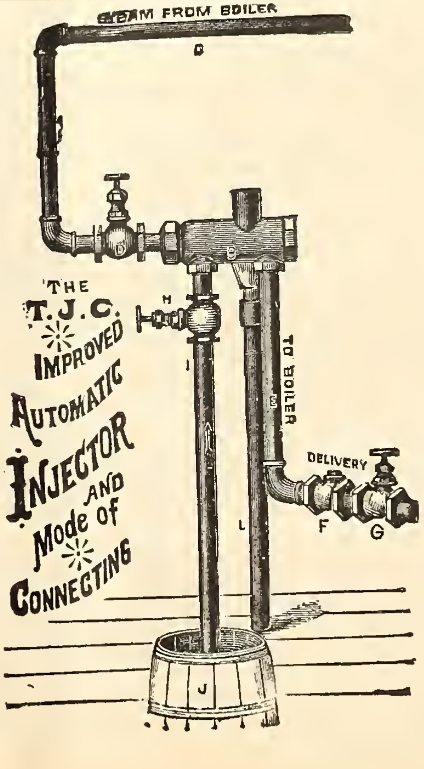

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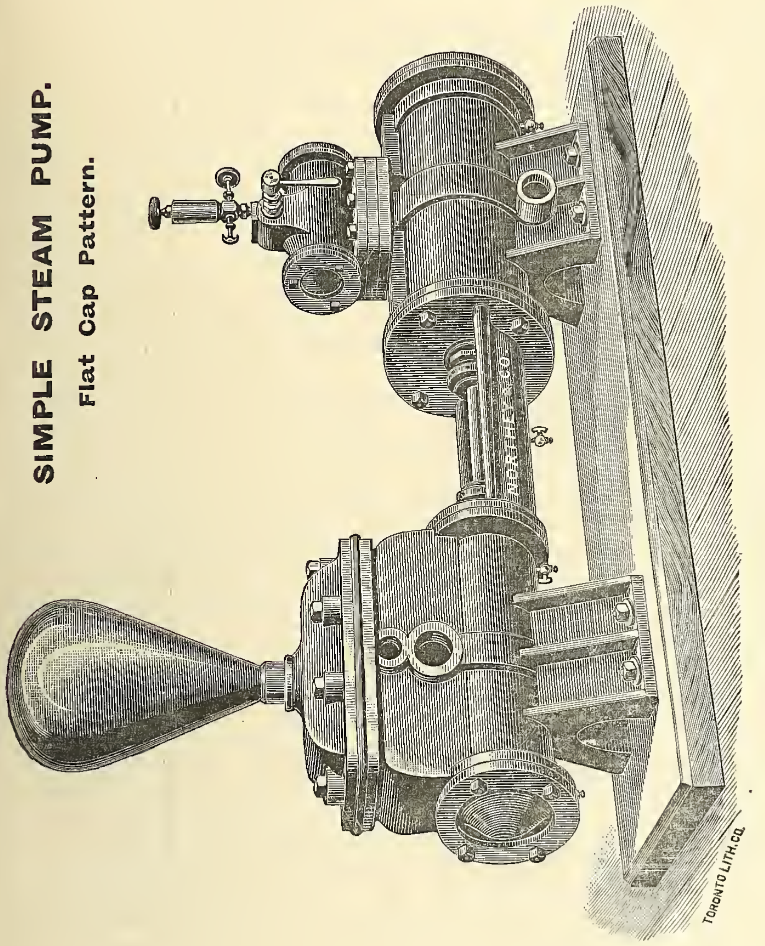

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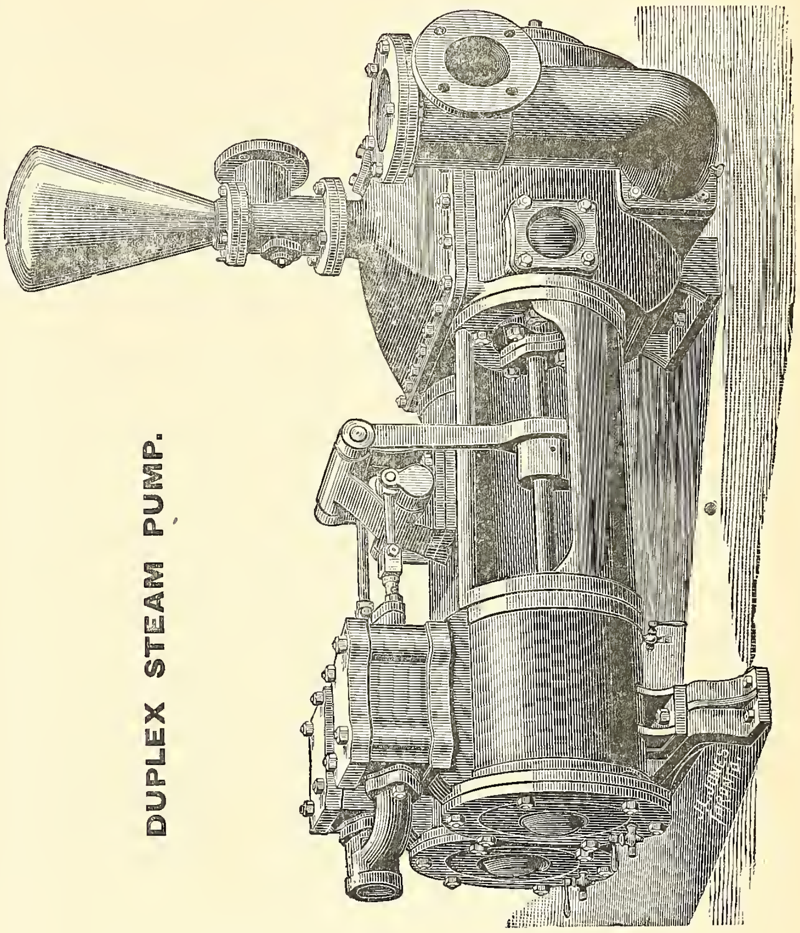

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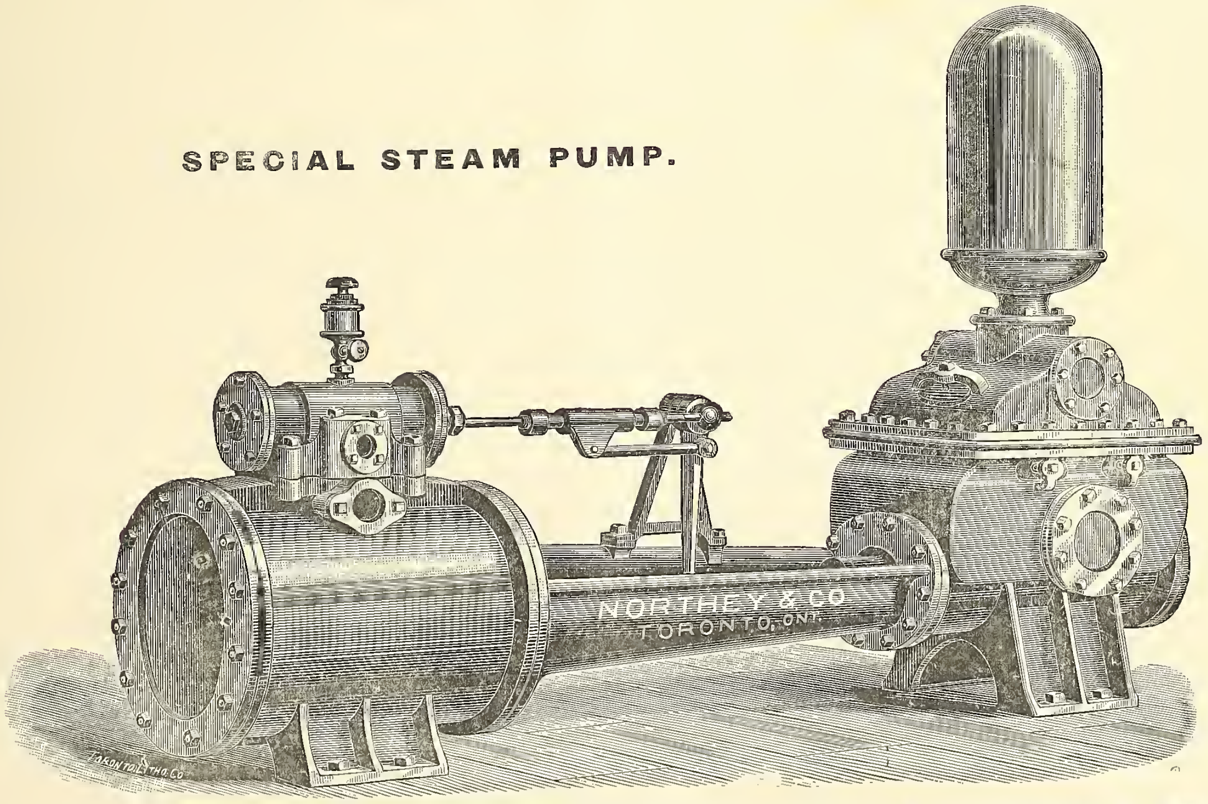

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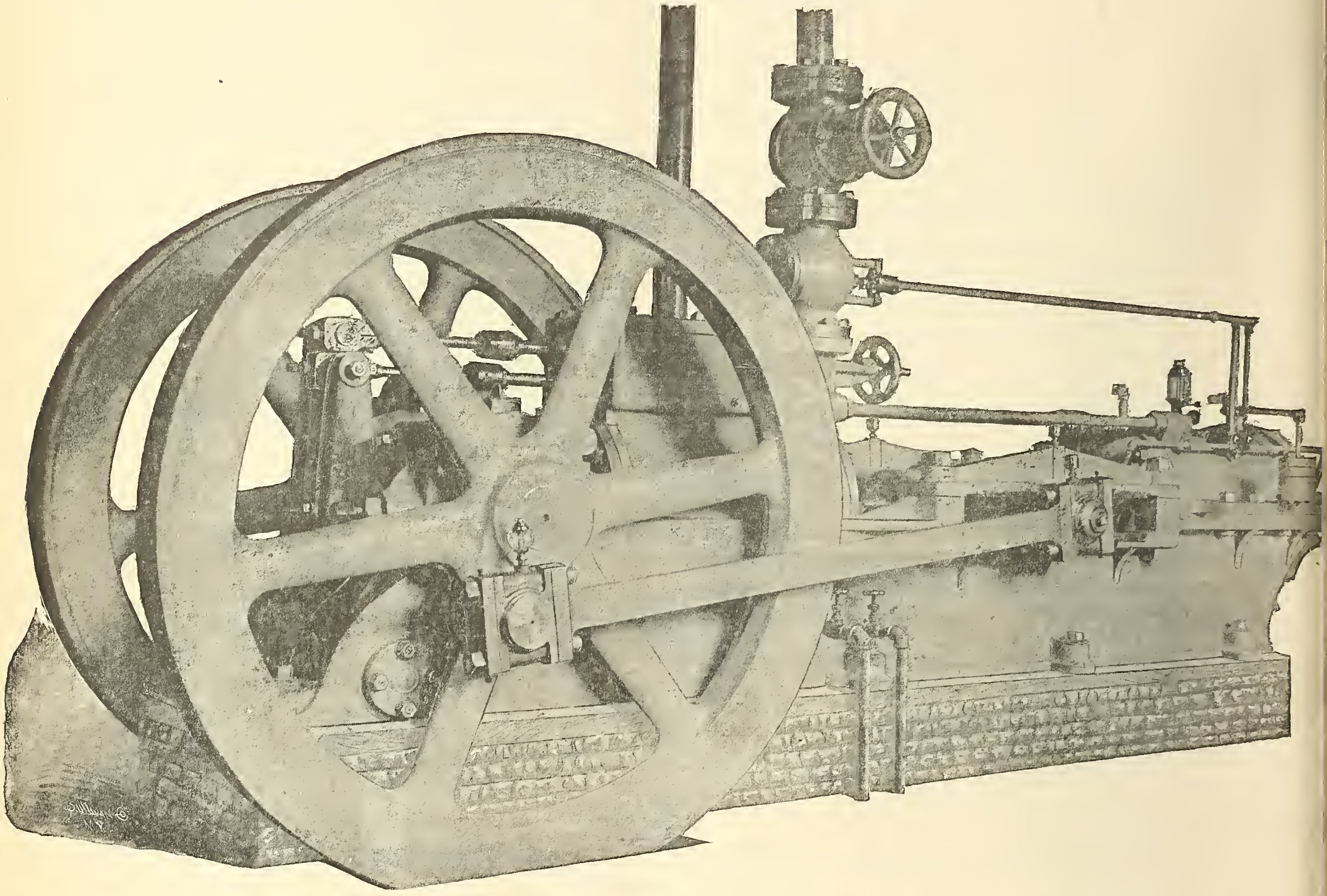

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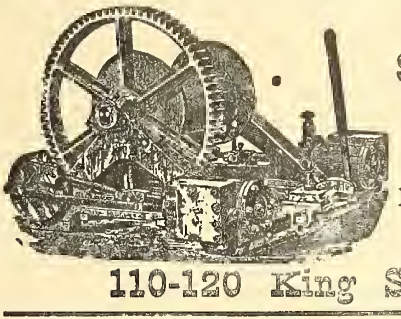

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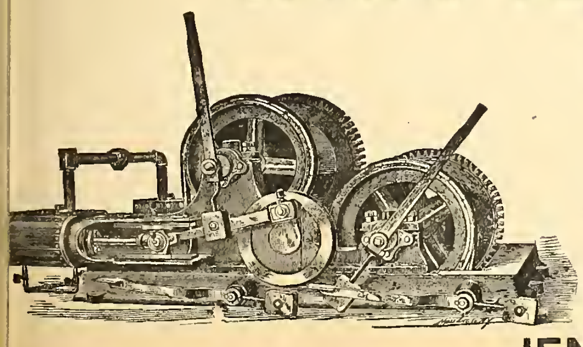

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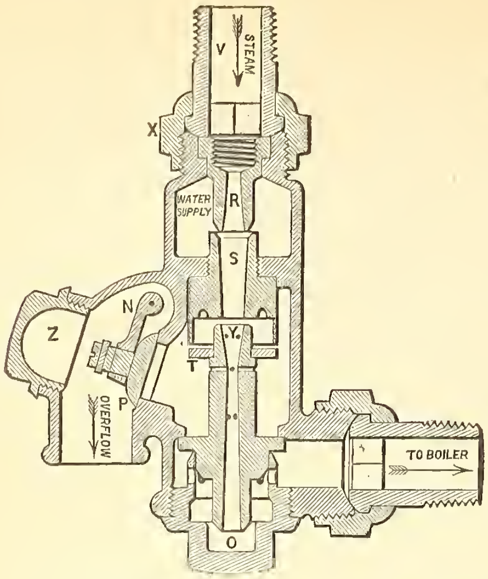

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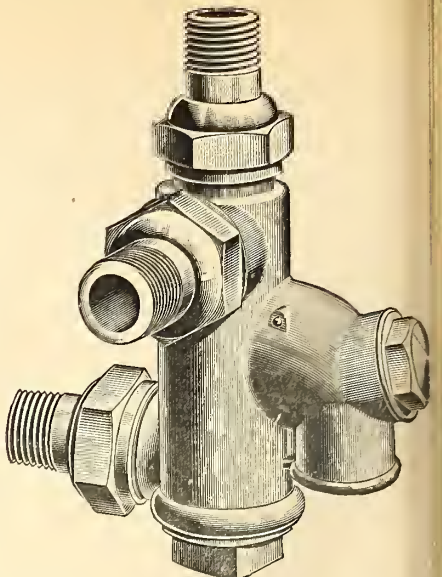

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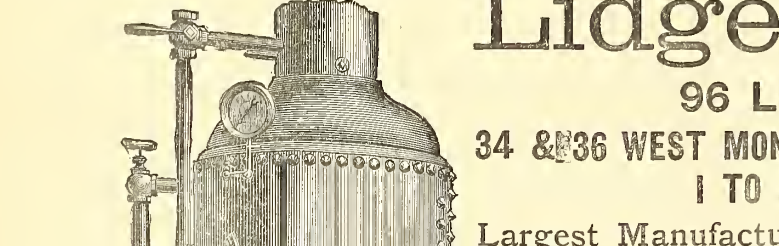

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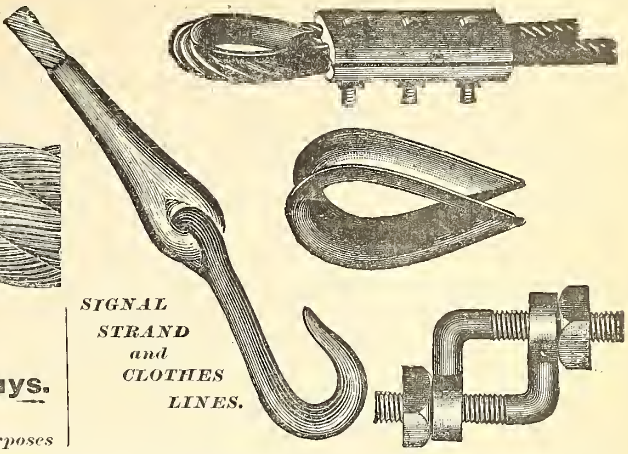
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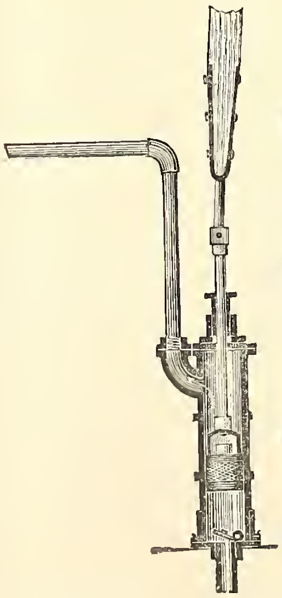

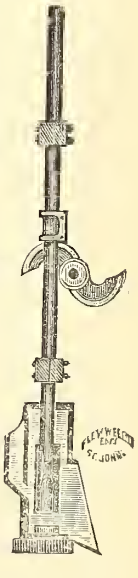

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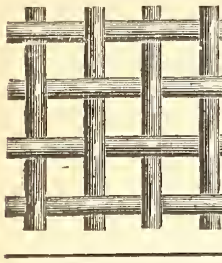

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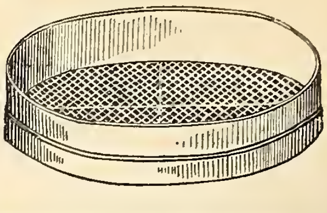

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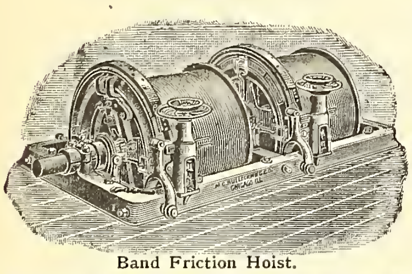

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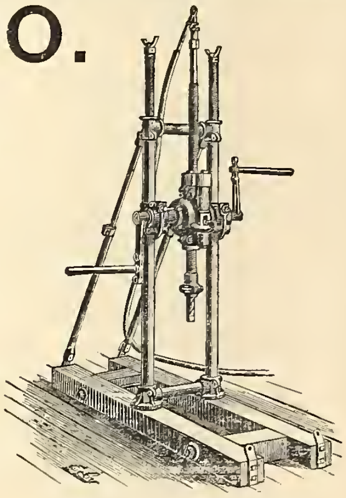

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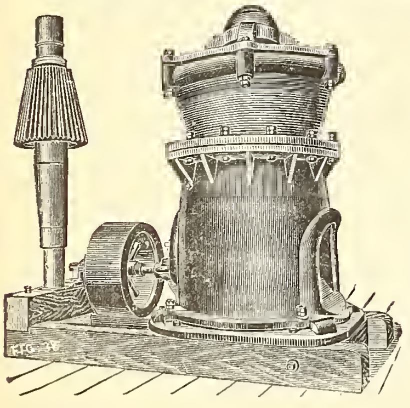

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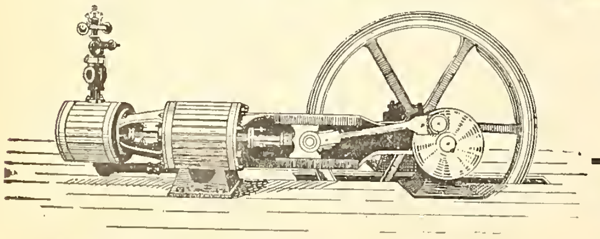

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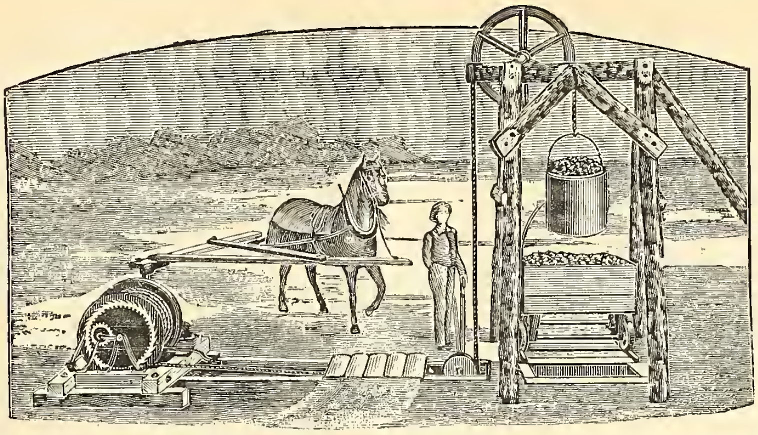

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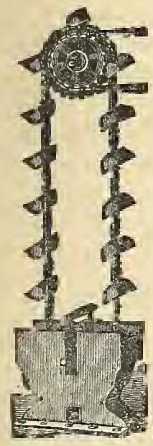

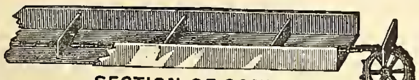

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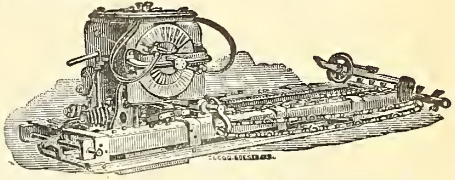

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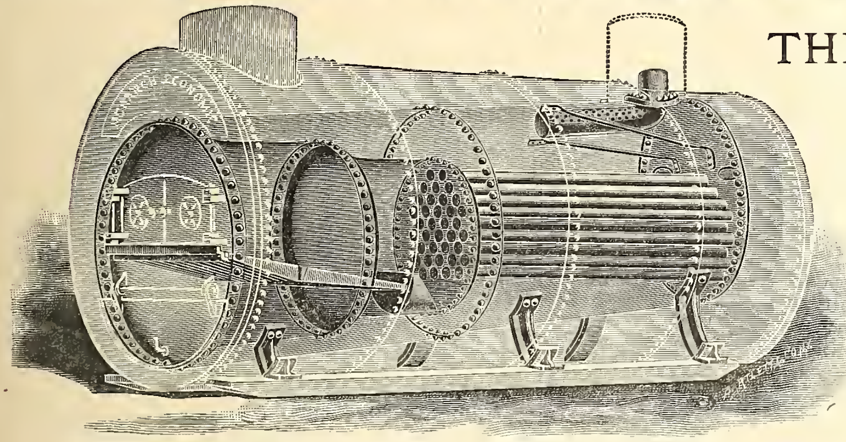

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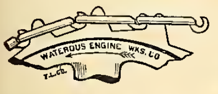
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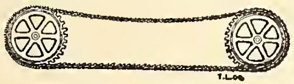

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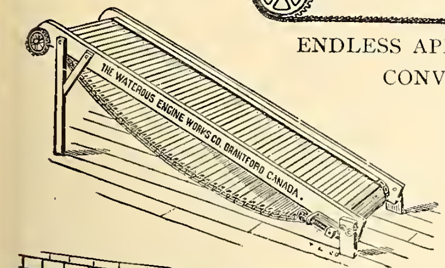
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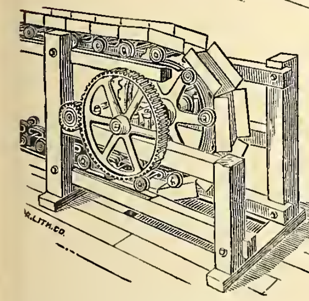

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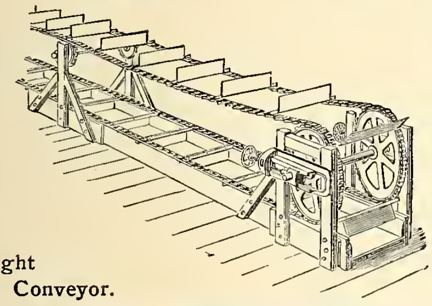

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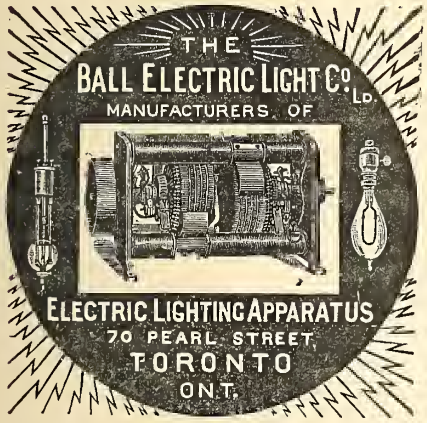

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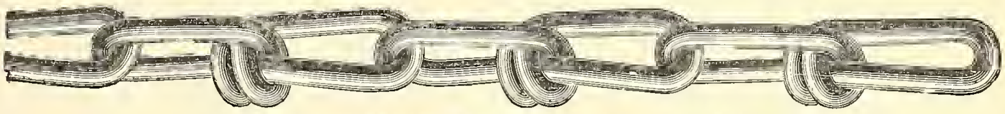

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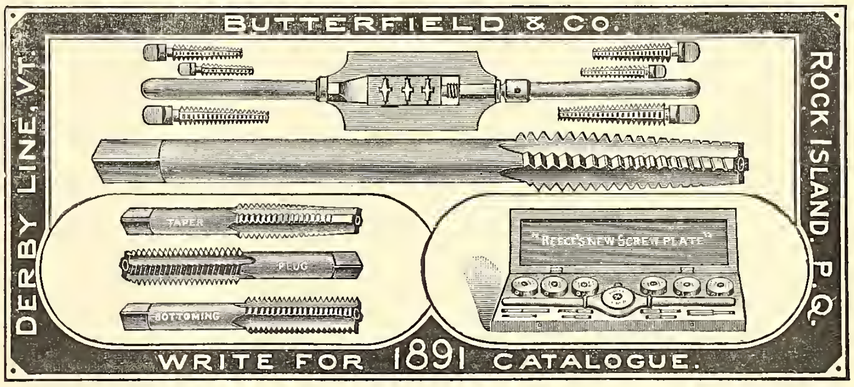
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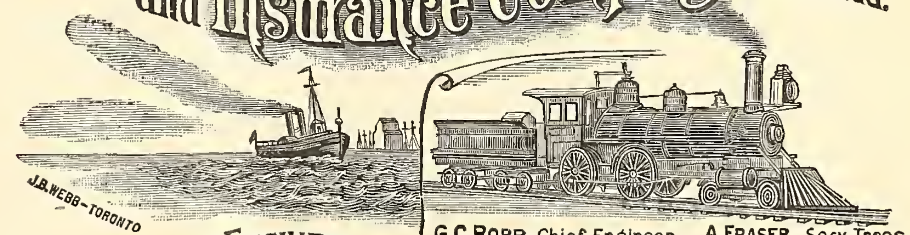

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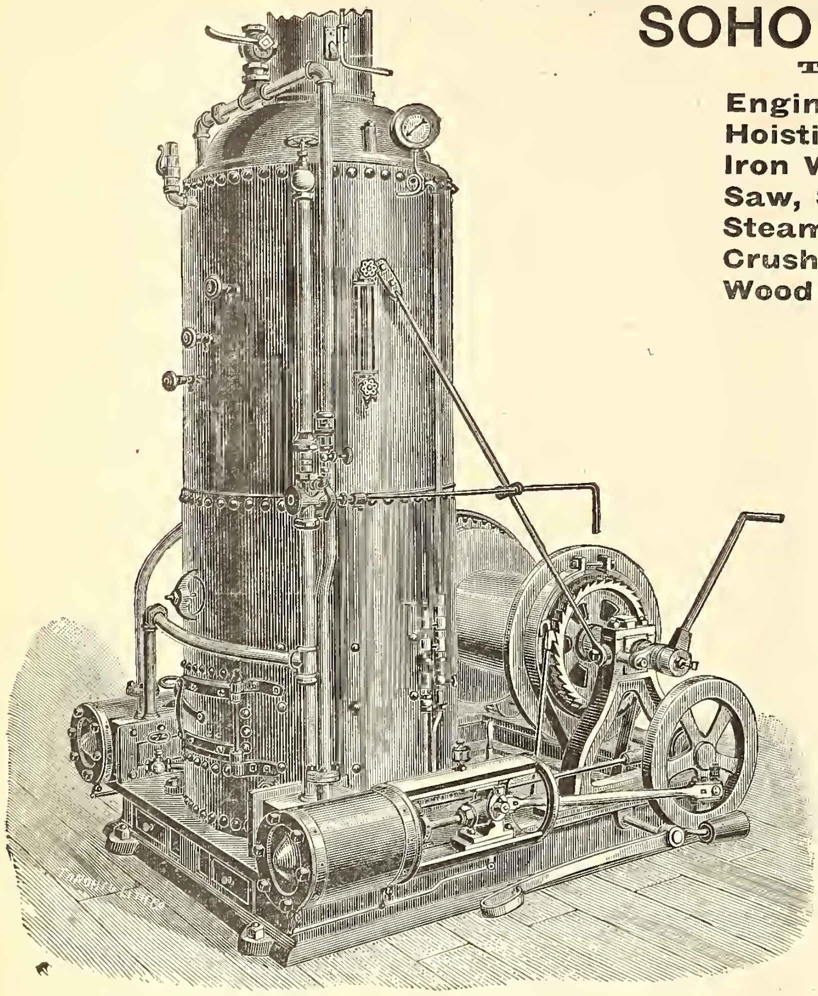

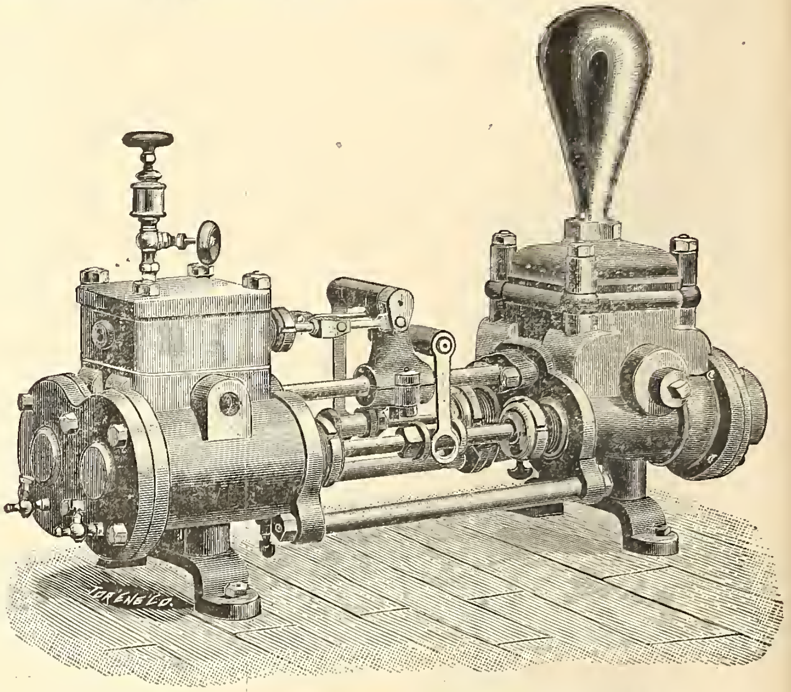

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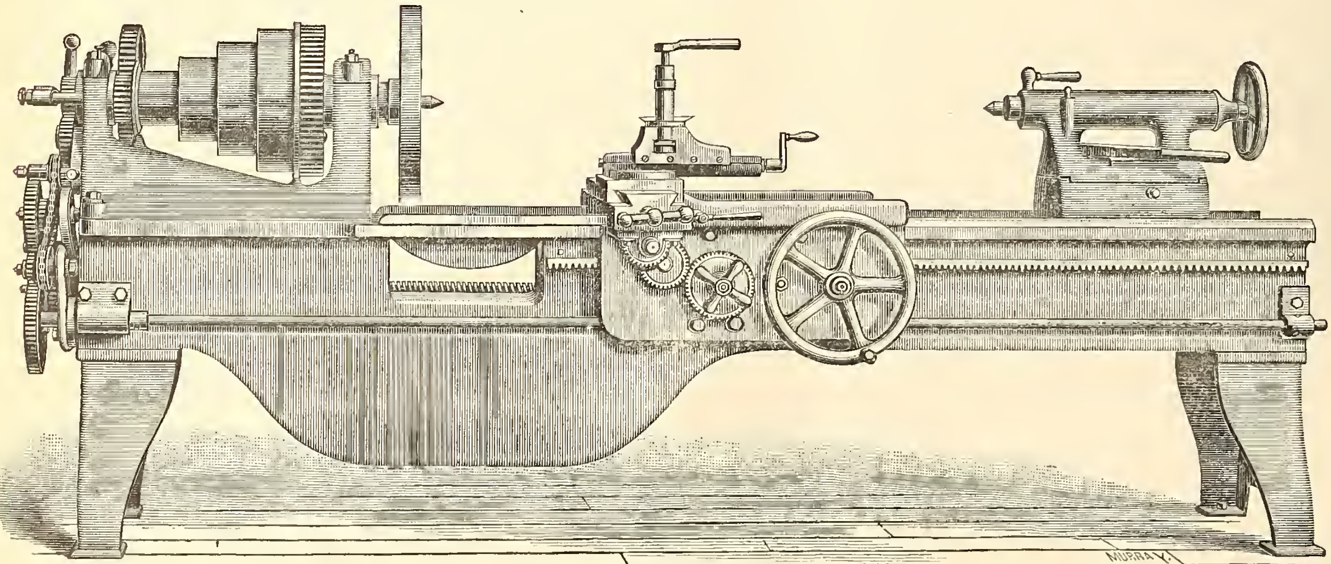

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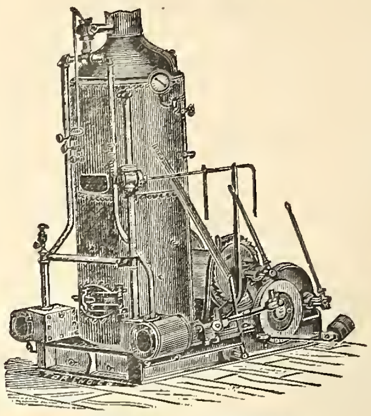

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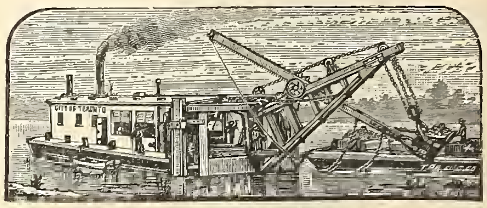

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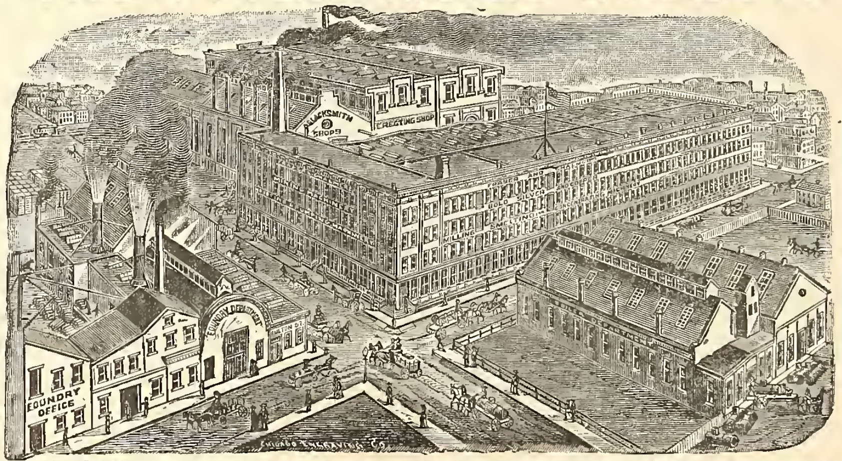

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The Outlook for Phosphates.

The feverish excitement attending the discovery of large phosphate beds in Florida has now somewhat abated, and the facts of the case have become pretty well known, through the published investigations of competent and conscientious experts. It is, therefore, possible to look over the situation with calmness, and to gauge with some degree of accuracy the effects of this new source of supply upon the markets of the world. Among the first questions that present themselves in this regard are those relating to the nature, occurrence and composition of these phosphates and the manner in which they differ in all these respects from the Apatites of our own country; and, although various answers have been suggested by different authorities, the most reliable conclusions can now be drawn from industrial and commercial results. It is necessary in approaching this subject to remember that the phospates of Florida are of two kinds—RIVER and LAND—and it will save some confusion if we at once point out that it is only with the latter that we Canadian miners of high grade apatites need concern ourselves. The gravelly or nodular of the Florida river-beds, or swamps, will bear no comparison with our product for many reasons; the chief being that their percentage of phosphoric acid is too low, and their percentage of iron and alumina far too high to meet the requirements of manufacturers of water-soluble superphosphates. The actual cost of raising them to the surface is represented, and perhaps truly, as being very low, but this is more than counterbalanced by the scarcity of labor and the lack of facilities for transportation; and we are therefore justified in regarding them as a species of gigantic reserve, to be called upon by future generations of farmers when the beds of the well known, equally cheap and accessible, and more esteemed material in South Carolina have begun to languish. According to Dr. Francis Wyatt, the geological formation of the "land" or "rock" phosphate is superposed upon a foundation of much-fissured Upper Eocene limestones, and is made up of extremely irregular pockets, or banks of siliceous, marly, and phosphatic material heterogeneously jumbled together. The pockets are sometimes of immense extent, and at others of only very narrow dimensions. The banks consist principally of boulders, rolled up by the action of water and cemented together by a siliceous mud, hardened by evaporation and exposure. This description being applicable to the entire State, it follows that the Florida phosphates, like those of similar origin in other parts of the world, are nothing if not capricious, uneven and deceptive. As an illustration which we may very fairly consider typical of this uncertainty, we may refer to the published report of an expert chemist and engineer of New York, who was sent to Florida to examine a tract of 5,120 acres of land in the heart of what is called the "phosphate belt." The most attractive indications of phosphate rock were everywhere prevalent; sometimes in the form of huge boulders outcropping on the surface, and more generally in the form of small debris, brought up from below by the industrious male. A thoroughly systematic examination proved that the actual amount of land on the entire tract containing workable deposits of phosphates was only 83 acres, and that this area was not all in one piece, but was made up of small portions varying in size from a few feet to two or three acres. Their depth of phosphate-bearing sands and clays ranged from 15 to 30 feet, and the thickness of the phosphate deposit itself was from 3½ to 27 feet, the average, however, being no more than 8 feet. It was made up of about the following components:—

13 per cent. by weight of large and small boulders of 80% phosphate of lime.
29 per cent. by weight of debris and soft white matter of 60% phosphate of lime.
56 per cent. by weight of sand, clay, flints and waste.

The color, texture and specific gravity of the phosphate varied almost with every pit, and while in some of the beds the higher grades contained only a very small percentage of iron and alumina, in the majority of cases the output was heavily loaded with these injurious constituents. A careful estimate placed the yield at 5,000 tons per acre, of material having the above composition, so that we may reckon on some 650 tons per acre of about 75 to 80 per cent. grade. The desultory manner in which the pockets were scattered over the whole surface of the tract made it a matter of difficulty to place a fair valuation on the 83 acres of land which alone were of exploitable value. It was therefore necessary to acquire 5,037 acres of "dead" land, and to distribute the working over the entire body!

The inconvenience or impracticability—to say nothing of the cost—of establishing such widely distributed quarries, becomes obvious when we take into consideration the methods of exploitation. These phosphates have first to be dug out of the quarry and brought to the surface, carefully selected from the impure adhering matter with which they are connected, thoroughly washed in running water, and finally either dried in the sun or piled up and burnt in kilns! Every one of these operations requires skill, but there is still another of paramount importance which has still to be mentioned. We allude to the final process of selection for foreign shipment, whereby everything under 70 per cent. of lime phosphate, and exceeding 4 per cent. of iron and alumina oxides, are excluded from the piles. Without daily and accurate chemical analyses of the entire output, even expert miners go wrong in this last manipulation and blunders are found to be inevitable, all the more disastrous from the fact that the whole mining cost is thrown upon the higher grades. No market has yet been found for the immense quantities of second and third qualities, which must necessarily be taken from the pits, nor can we see the least chance in the near future of finding an outlet for them. In the first place, there are no facilities for their cheap transportation to points of consumption; and in the second place, they contain so much iron and alumina that in the ordinary process of manufacture no experiments have yet succeeded in making them sufficiently dry for commercial purposes.

These aspects of the question strike us as most worthy of attention, for they immediately suggest that Florida is hampered as a shipper of high grade phosphates by difficulties of great magnitude and importance. Before she can hope to justify her pretensions as a producer of the first rank, or to seriously and permanently influence our markets for good or evil, she must give more distinct evidence of her capacity than has been hitherto forthcoming. There can be no doubt that she is passing through the critical period of her history, and that those interested in agriculture and fertilizers are turning towards her with growing anxiety. This fact, however, only adds emphasis to the questions which have been so often propounded and are still unanswered: Where are her "Bonanza" deposits of high grade rock, and how are they to be exploited at a profit? For our own part we see no ground for the discouragement lately evinced by a few of our Canadian miners, and we do not hesitate to counsel those who have interests in our apatite deposits to preserve their courage and await further developments with confidence and composure. They will yet be called upon to witness the discomfiture of many unfortunates who have allowed themselves to be led away by exaggerated reports and excited first impressions. Florida is still, to a very great extent, an unsettled country; her climate is notoriously malarious in the phosphate belt, and she is subject, besides, to periodical and severe visitations of yellow fever. Her transportation facilities are imperfectly developed and wretchedly managed, and her railroad companies are poverty stricken and incapable of furnishing the rolling stock necessary for the extension of a great industry. Her people are speculative and enthusiastic, but are neither practical nor laborious, and while the negro, upon whom will fall the burden of the mining work, is an unoffensive, cheap and docile servant, he is shiftless and unreliable. We do not make these statements with a view to underrating the importance of a competitor. We are not so blind as to be unable to see the "Writing on the wall;" but we speak thus plainly because after mature consideration and minute enquiry we have concluded that Florida's resources have been grossly exaggerated. According to our information there is a yearly market in European centres for about *150,000* tons of phosphate of lime of 75 to 85 per cent. The buyers impose as a condition of their contracts, that the material supplied to them for manufacturing purposes shall contain no more than three per cent. of combined oxides of iron and alumina, and they attach penalties to this condition sufficient to secure its observance by miners and shippers. Of the hitherto principal sources of the world's supply of phosphates, many are well known to be slowly but surely failing, and leaving Florida out of the question as a doubtful factor, it is difficult to predict where, if not in Canada, we are to look for increased contributions. If Florida does not fulfil what has been predicted for her, it will not, in any case, be from lack of opportunity, for within the last two years there have been incorporated no less than eighty odd companies for the purpose of wresting from her sandy bosom her presumed exhaustless phosphate treasures. Of this large number some will naturally prove to be merely ephemeral, and will disappear as suddenly as they grew, but there are others which are operated by men in the highest rank of science, industry, commerce and finance; yet what are the results thus far accomplished? They are not difficult to tell, and may be summed up in the brief statement that the total quantity of phosphate shipped to Europe, or in other words to our customers, from all parts of Florida since the commencement of operations in 1889, does not exceed 20,000 tons of an average quality not exceeding 75 per cent.

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The Springhill Explosion.

This explosion, the third of the great coal mining disasters in Nova Scotia, has claimed for its victims one hundred and twenty-five men and boys. The collieries of the Cumberland Railway and Coal Company are at Springhill, in Cumberland County. Three seams are worked. The east seam slope, in which the explosion occurred, has reached a depth of 2,500 feet. At a depth of 1,900 feet, a level had been driven about 3,200 feet to the westward, and near the end of this level two counterbalance roads had been driven in the coal to the next level above, a distance of 600 feet. From these balance roads, horizontal workings, or bords, had been started and were being worked at the time of the explosion. About the middle of the workings, in the balance road furthest from the slope, the coal, about eight feet thick, was divided by two feet of stone into two benches five and three feet thick. The lower and thicker band only was worked. At points it was necessary to blow down some of the stone to allow the pit tubs to pass. The evidence showed very clearly that a shot had been fired at this point, in this stone, as the body of the man employed to fire the shots was found a few yards away. It appeared on examination of this part of the mine by the jury, who were mostly practical miners, and took a deep interest in the investigation, that the charge of powder had been excessive, and that the flame of the shot had either kindled some gas or had been powerful enough to distil from the coal-dust enough gas to cause a heavy explosion.

The investigation before the Coroner, Dr. Black, of Amherst, was of a searching character, and took in all the details of the management of the mine. The duties of the sulphur men, shot firers, brattice and shift men, their instructions, reports, etc., were fully considered. Evidence was taken as to the ventilation, dryness of the mine, etc. After full and mature deliberation the jury confirmed the public opinion of the mining fraternity, which had been, that at this mine all possible precautions had been taken for the safety of the men.

The verdict returned by the jury read as follows:—

"That the explosion was caused by the flame from a shot fired in No. 3 bord of No. 7 balance, igniting coal dust and a certain proportion of gas which may have been present at the time.

"They also believe that there was an unusual flame from said shot owing to a slip in the stone.

"They believe that the explosion was accidental, that no blame is attached to the management, and that they have taken every precaution for the safety of their workmen, and they make the following recommendations:

"*First.*—That in future, where safety lamps are used, and in very dusty places, powder should not be used.

"*Second.*—They recommend that in gaseous portions of the mine, before the men resume work after dinner, the places should be examined by competent officials.

"*Third.*—They recommend that the Local Government procure for the use of the Deputy Inspector of Mines a Shaw machine for detecting gas."

The above brief recommendations are of a practical nature, and if carried out would assist greatly in the preservation of life and property. Where there is gas enough to warrant the use of safety lamps, it is an anomaly to allow at intervals the discharge of an amount of powder equal in its heat and searching effects to many open lights; and in the same way when it is necessary to use safety lamps where both dust and gas are present, the use of powder is equally inexpedient. The abolition of powder brings up the still mooted question of what explosive can be trusted. The many ingenious expedients of lime cartridges, hydraulic wedges, compressed air, ratchet wedges, etc., have not been practically adopted by coal miners, and each new invention seems to create an equally new crop of objections; presumably the increased cost of the coal is at the bottom. Of the various explosives, roburite, a mixture of nitrated napthaline and nitrate of potash, seems to have found most favor. It has been used at the Intercolonial Colliery, Pictou County, and, it is stated, with satisfaction.

Should the recommendations of the jury prove agreeable to the Government, and a restriction be placed on the use of gunpowder in the coal mines of the Province, there is no doubt that the cost per ton of the coal will be increased, to an amount more than offsetting the inferior quality of the hand dug coal. As between the Pictou and Cumberland mines this would not cause much discrimination, but in Cape Breton, where some mines show gas, and others are reported as free from it, such legislation would be felt by some to be a serious matter. However, when regard is had to the immense tonnage of coal in Pictou County destroyed by fires, many of which can be traced to shot-firing, and to the many lives that have been lost, it may be conceded that the Province would be better off had no powder been used there for the past twenty-five years. If the mines be regarded, as they are in point of fact, the property of the people of Nova Scotia held in trust by the local Government, then the interests of our successors deserve consideration. Already in Pictou County there are large tracts of workings in which no powder is used and no open lights are allowed.

It seems incredible that with the advances made in safety lamps, electric lighting, electric and other coal cutting and wedging devices and improved explosives, that the time has not arrived when the use of so rude and dangerous an explosive as gunpowder can be dispensed with. With prophetic eye the miner of the future may be seen working in an atmosphere equally pure with that above ground, lighted by the brilliant rays of electric lamps, and readily and without toil extracting through the giant forces of electricity the treasures of the world below.

Turning from the horrors of this subterranean slaughter, it is pleasing to note the promptness and bravery of the comrades of the victims, who repeatedly risked their lives to rescue not only any possible survivors, but to restore promptly to sorrowing relatives and friends the remains of those who had been killed. This work was steadily carried on amid the foul air and the dangers of falling roof and stone in the exploded district, where every prop and support of the roof had been swept away. The efforts of the relief committee, and their appeals to public sympathy have been promptly answered, and there is every indication that a fund will be raised equal to the task of supporting the dependent relatives for some years to come.

It is also a matter of congratulation in the interest of the general public as well as of the company, that the explosion did not set fire to the mine, as too often happens. The destruction of the two fine mines that were the seat of the disaster, with their slopes, engines, bankheads, etc., would have crippled the company and the town of Springhill, and have proved a Provincial disaster. There were here at one time four slopes, on the three seams of coal being worked, and they were all connected. The management had isolated two of them and were about to isolate the rest. The wisdom of this course is apparent, as there is little doubt but that had these precautions not been taken a greater loss of life might have happened.

◆

The value of the gold exported by the banks at Victoria during last year was:—

Bank of British Columbia	$203,111
Garesche, Green & Co.	183,587
Bank of British North America	25,331
	$412,029

EN PASSANT.

On another page of this issue will be found an account in detail of the third Annual Meeting and Dinner of the Gold Miners' Association of Nova Scotia, held at Halifax, on the 10th inst., at which the REVIEW was a participant. The occasion was one of unanimity and good fellowship, and was thoroughly enjoyable.

This Association has now rounded out three years of active, useful life; it has trebled its list of members, and has, in a quiet, unobtrusive, but effective way, accomplished a very creditable amount of good work for the gold mining industry of Nova Scotia. The need of such an organisation has been shown by its continued existence and increased prosperity, and the REVIEW wishes it many annual meetings of as happy a nature as the one just passed.

At the business meeting, held in the afternoon, some important amendments and additions to the existing Mines Act were fully debated in a most interesting manner, and it is opportune for the Quebec Government to note that they were chiefly in the direction of obtaining a more liberal as well as a more secure title. The deficiency of the Nova Scotia Act in this respect was well set forth in the paper "On Titles," read by Mr. B. C. Wilson, at the October meeting, which we reprint elsewhere.

Measures looking to the establishment of a permanent base line marked by stone or iron monuments in every gold district, and also providing for a barrier of unwrought country rock between lands owned by different and diverse owners, were also debated, and were committed to the Council to secure enactments of the same.

A pertinent query comes from a Cape Breton miner with regard to the cause of the Springhill explosion. He asks: "Why was the air not split to ventilate sections separately, and thence direct into return air-way? Does it not seem strange that the air having first passed over safety lamps should be returned over naked lights? What was there to prevent a fall of roof in any of the balances, forcing gas down on the main trolly-way, 1,900 foot level, or through on to No. 6 balance?"

Copies of the following resolution, passed at the last regular meeting of the Canadian Institute, Toronto, have been mailed to the mining men of the province:—

> "The Geological and Mining Section of the Canadian Institute are of opinion that until a Provincial Department of Mines is established, the mining and metallurgical interests of Ontario cannot receive that attention which their importance demands, and therefore recommend that a Mining Convention be called to meet in the city of Toronto, at the Canadian Institute, on March 31, at 10 o'clock a.m., to consider measures for the advancement of the mining industry and the advisability of establishing a Provincial Department of Mines. The Institute is hereby requested to give notice calling upon the various mining localities throughout the province to send delegates to meet the delegates appointed by the Institute for the purpose of laying their views before the Provincial Government."

It is requested that representatives be sent to this convention, and the invitation is made general to all interested in mining in Ontario. We are heartily in accord with the object of the meeting, and trust that good will result.

We are very much pleased, and so will be all our Canadian readers, to learn of the election of Mr. John Birkenbine, M.E., of Philadelphia, as President of the American Institute of Mining Engineers. Mr. Birkenbine, who is well known in the Ottawa Valley for his papers on iron and its possibilities of manufacture at Ottawa, has at present charge of the iron ore statistics of the Eleventh Census. Mr. Birkenbine is alo the mainstay of that excellent periodical the Journal of the Charcoal Iron Workers of the United States.

The trouble at the Wellington, B.C., collieries has assumed a serious aspect; there have been what verged very closely upon riots, and it is feared that the conduct of the strikers may go from bad to worse. The original difficulty seems to have been almost lost sight of in the later issues, and affairs have reached a stage when any settlement has become exceedingly difficult. The situation is much to be regretted, not only on it own account, but also from the fact that an important coal producing centre has become in great part inoperative, and has lost ground that it will take long to recover.

Considerable prominence is given in some of our western papers to the reported sale to an Anglo-American Syndicate of the Badger, Porcupine and other well-known silver mines in the Port Arthur district. These properties having given substantial proof of their ability to produce in paying quantity are unquestionably of great value, but in view of the absolute silence maintained upon the subject by those interested, the report that $10,000,000 have been realised should be taken with a strong pinch of salt.

To all appearance the first Quarterly General Meeting of the General Mining Association of the Province of Quebec promises to be a notable one. Papers will be read by Dr. R. W. Ells, Ottawa; Rev. Abbé Laflamme, Quebec; Dr. J. T. Donald, Montreal; J. B. Smith, M.E., Glenalmond, and A. M. Evans, M.E., Black Lake. The subjects promising a lively discussion will be those by Messrs. Evans and Smith on "The Responsibilities of the Mine Manager," and "Mine Inspection," respectively. The Meeting will take place in the Windsor Hotel on Thursday 30th April, and in all likelihood will be celebrated with a dinner.

A new boring apparatus for mines has been brought out in England, which is especially designed for use in places where there is a possibility of breaking through into old workings or places in which gas or water may be pent up. With this invention the hole in the coal or other mineral is made gas and water tight from the insertion of the boring tool, and the pressure of either is indicated on a gauge attached. The tube proper is inserted in an outer casing which is placed in a hole two or three feet in depth, and secured to a timber frame as a fulcrum, at the outer end, and beyond has bolted to it a sleeve nut tapped to receive the screwed length of the feed screw of the boring bar, which is operated by manual or other power. At some convenient portion of the casing tube outside of the "face," a downward branch is provided, which is closed by a straight through valve, which, being opened, allows the debris from the boring tool to fall downward to the floor of the seam.

The patent cure-all man, the life insurance agent, and others of that ilk, have gained a well deserved reputation for unmitigated cheek and cool impudence, and their names will go down to posterity. But a new rival has appeared in the field who bids fair to rob them of some of their laurels. This formidable competitor is actively engaged in pushing an article known as "Shaw's Gas Testing Machine," and the calm impudence of his methods of business almost rise to the height of genius. The following is an extract from a letter written by him to the manager of a large Nova Scotian colliery: "Unless you do avail yourself—and soon too—you may live like Cowans to regret that it was ever your misfortune to be a mine superintendent. You know the responsibility—I know the condition of your mines. Deliberate." In the face of such assurance we are speechless!

From the report of the annual meeting of Bell's Asbestos Company, reproduced in another column, it will be seen that although a large dividend, 15 per cent., was paid, yet it has decreased materially from the percentages paid in the last two or three years. The Canadian business is not responsible for this—that has been as productive as ever—but the English trade has fallen off very considerably, owing to the disclosures regarding the "gratuity system," which appears to have prejudiced the public against the company. How far this sentiment is justified is not for us to say; the modes of doing business vary greatly on different sides of the Atlantic, and what would be severely condemned in one country may be "winked at" in another; the unpardonable crime is to be found out. The financial position of the company is strong, however, and the present disfavor in which it is held should result in greater purity in the future, when it may regain the ground lost in the past year.

At the present time, when the Springhill disaster is fresh in our minds, the conclusions reached by the Prussian Firedamp Commission, elsewhere reproduced, are of especial interest. It may be remarked, however, that these experiments, while of undoubted value, did not show such uniformity of results under similar conditions as would warrant the drawing of anything more than inferences as to the explosiveness of coal dust. In some instances, with the same charge of dust, an explosion would follow in the one case and not in another, without any visible cause for the difference. Moreover, the conditions of an artificial test and an actual explosion in a mine are very different: in the one the atmosphere is charged with dust to a very appreciable extent, such as no miner would fire a shot in, and in the other, the dust is lying for the most part on the floor.

From returns received from the three principal railway lines we are enabled to publish the following estimate of the contracts for supplies, made for the ensuing year by our Nova Scotia collieries :—

Colliery.	Quantity.
GRAND TRUNK RAILWAY.	
Gowrie	35,000
Springhill	65,000
CANADIAN PACIFIC RAILWAY.	
Cape Breton	120,000
Pictou and Cumberland Co.	65,000
INTERCOLONIAL RAILWAY.	
Springhill	100,000
Acadia	40,000
Phœnix	25,000
Intercolonial	20,000
International	3,000
Glace Bay	1,000
	474,000

The following letter from the Canadian Copper Company, under date of 16th instant, will be an eye-opener to our gullible friends in the West, who have pinned their faith on Mr. Ritchie's chimerical schemes and bombastic utterances :—" Mr. S. J. Ritchie, formerly an officer of the Canadian Copper Co., has ceased to have any connection with the company as a director, officer or stockholder, and he does not represent the Company in any capacity whatever. It has recently come to the knowledge of the Company that Mr. Ritchie has assumed a position of hostility to it, that he threatens it with malicious law suits and interference with its business. All persons having any business with the company will oblige us by paying no attention to any correspondence or interviews of Mr. Ritchie. The Company will, through its proper officers, attend to its affairs and the performance of all its contracts. By order of the president."

Apropos of the recommendation of the coroner's jury on the recent Springhill explosion, it may be well for our miners to consider the following objections to the Shaw Testing Machine :

(1). The machine does not register the presence of gas, even when in perfect order, except in the immediate vicinity of the mouth of the tube, and as the miners will be led to believe it is perfect in action, they will not exercise the usual care and prudence, and the result will be more accidents due to explosions of gas.

(2). The pipes will be continuously out of order, as it will be impossible to guard against the joints being forcibly broken, through falls of top and sides, squeezes, etc., and droppers of acidulated mine-water eating holes in them.

(3). In cases of outbursts of gas, one of the most dangerous forms in which it is encountered, the fire-damp will reach the miners' lamp as soon as it will the mouth of the tube, and if the miner is depending on the machine for safety he will be burned before any signal can possibly be given him.

(4). It is proposed to place a single tube in each working place. If there was any possible means of determining the proper location for the mouth of this tube it would not be required, as if it is known where gas will appear it can be watched and guarded against. The idea of the owners of the machine, is to place a tube at the highest point near the face of each working place. As these faces are swept with currents of fresh air which dilute and carry off the gas evolved there, it is more likely to accumulate in dangerous quantities in other parts of the workings. *Where those points are it is impossible to designate.*

(5). The principles of the machine are not new. They have been proposed before on the continent of Europe, and after exhaustive inquiries into their merits, they have been discarded as worthless and dangerous.

The apparatus cannot be operated so as to give warning in all cases of the presence of fire damp in collieries where its appearance is only occasional. In mines where there is a continuous and general evolution of gas from all the workings it cannot be applied because it will require more pipes than can be put into the mine openings. The large number of pipes (if but a single pipe is run into each working place), will fill up the main air or haulage ways, interfere with the ventilation, and prevent the working of the colliery.

The French Fire Damp Commission, whose report has recently been issued, condemns three similar appliances that were brought to its notice in the following terse language :—

" They are absolutely analogous to systems proposed for a long time to all commissions.

"A similar process was tried in Germany by Herr Hilt and abandoned as producing no effect as regards security.

" It would be useless since it is likely to sound every day in certain gaseous mines, or, again, not to sound, though the remainder of the mine is full of fire damp because there was none at the point where the apparatus was placed.

"An impracticable process in a mine with a continuous and general escape of gas and unrealizable in fact.

" This apparatus has the inconvenience of all warnings which may be found in places where they are of no use and are wanting in points where they are necessary."

The two Liberal candidates for the county of Pictou, N. S., in the recent contest expressed themselves something to this effect in addressing the coal-mining population of the district : " A large number of you are engaged in coal mining, Notwithstanding the contentions of partisans to the contrary there is not the slightest reason to doubt that the future of this great industry is largely dependent on our success in obtaining the markets of New England. Look at this fact. In the year 1853, when our coal was taxed by the United States, our sales then amounted to 120,754 tons. In 1854 it was admitted free, and that condition prevailed until 1866, at which time our sales reached the amount of 404,252, when it was again taxed. From that time forward, owing to the American tariff, the sales decreased. Let it be made free again and a far greater increase will take place commensurate with the largely increased consumption of coal by the New England States." The force of these arguments do not appear to have been appreciated by the electorate, for both were defeated by an over-whelming majority.

CORRESPONDENCE.

The Shaw Gas Testing Machines.

SIR,—In response to your enquiry respecting the Shaw machine for testing gases in coal mines and the suggestion, after the verdict at Springhill, that it would be well if the Deputy Inspector were supplied with one, I take pleasure in giving you the following notes :—

The Shaw machine *per se* and the Shaw system of signalling, etc., must not be confounded together, for the latter, however ingenious, is wholly impracticable. This has been time and again, shown up in the columns of the Scranton *Colliery Engineer*, but in spite of these exposures the company pushing the patent persist in ignoring corrections of the false inferences made in their interest and in confounding the encomiums which I believe are worthily bestowed on the machine, with endorsations on the Shaw system of signalling.

For the Shaw machine as a piece of philosophical apparatus for use in the laboratory, I am full of admiration. Within the limits of its application, it is wonderfully accurate, and for occasional use I should be glad to have access to one, or know that the Deputy Inspector had opportunities to make tests from time to time.

But applied as proposed, for the daily examination of mines generating gas constantly and freely, as do ours, it would fall far short of the requirements. We *know* that gas is exuding at every face and that it will catch and lodge in an advanced shearing or any little cavity back from the face, but we are not interested in knowing whether the percentage in any one of the pockets selected for the termination of the "system's" ¼" tube be 7, 7·5 or 8%. What we do want to know is approximately the *quantity* that will collect in any spot ; the spots where, from time to time, as the circumstances change, it will collect, and the time taken for it to gather after being disturbed, and this information the safety lamp, in competent hands, gives us. The number of tubes, as, for instance, would require to make the tests now made, would be very great—so great that a special place would have to be kept and a gang of men would require to be constantly attending to the tubes and seeking fresh spots to which to take them. Not only at the working faces is gas given off, but from the freshly cut walls, from "backs" and "lypes" and "faults" left behind an exudation continues for a longer or shorter time. In the safety lamp we have a rough and ready portable instrument that finds the worst places and gives a crude gauge of the quantity given off. If we want more delicate tests of smaller percentages than the lamp shows, we have the Peiler lamps burning alcohol and Liveing's gas indicator, both portable instruments. The Shaw machine is not portable ; gas to be tested by it must be brought to it either by bag or pipe. Pipes being fixed give no facilities for searching ; the places where they might be most judiciously put, have to be found for them ; on the other hand bags are cumbersome and allow of but few tests for each entrance of the "fireman," each bag representing but a single test, while with the lamp the fireman makes perhaps 100 or more tests on each round he makes.

The Scranton mining paper has enumerated many of the objections to the "system," and clearly shown its incapacity to give that safety against explosives claimed for it and the cruel heartlessness of its promoters in proclaiming to the bereft families of sufferers, that had Shaw's system only been in use, such or such an explosion had not taken place.

In a late number, the *Colliery Engineer* put down to ignorance many of the misleading statements made by the "system's" promoters, but my experience with one of the gentry left me no such charitable thought. Like a sow that is washed, etc., did he return to his advocacy of the efficiency of the system's ¼" pipes to draw off all the gas from a mine although shown a section of level 50 feet long, from walls and roof and floor gas escaped bubbling visibly to the eye and with a noise distinguishable to the ear. Tests too that showed 200 cubic feet of gas mixed with the air of one return, failed to get an acknowledgment from him that one ¼" pipe would not find and carry it all off. He was well trained !

I showed him that the Peiler lamp *did* recognize 1½% of gas ; that the flame in a certain glass lamp did distinctly lengthen with a mixture the Shaw machine gave as of 2½% of gas, and yet so assertively perverted was this man's mind that he continued to repeat that the safety lamp would not show 2½% of gas—and his object in so saying was to make it appear that the safety lamp was totally inefficient and valueless for finding the presence of any less percentage of gas than 5 or 6%. Instead of the safety lamp being totally inefficient I will go so far as to say that in a gaseous mine where many tests have to be made and the option was given to use Shaw's machine alone or the safety lamp alone, the safety lamp would be given the preference by every competent practical man, and that no practical man ever made thoroughly familiar with Shaw's machine would trust to it alone to find out the true condition of his mine.

If, then, the Shaw machine is not suitable for the necessary daily examinations of a gaseous mine, you will ask, Wherein is it of value to the miner ? I should say for testing places where gas is supposed not to be, where open lights are used ; and for assisting in proportioning the several scales of air to the percentages of gas formed in different sections of the mine, it is accurate to the tenth of one per cent., while with Liveing's instrument and the Peiler lamp, allowances must be made for "personal error."

H. S. POOLE.

STELLARTON, N.S., March 14th, 1891.

The Ferro-Nickel Process.

SIR,—I read in your issue of December last, p. 183, a paragraph on nickel-steel. Your remarks regarding my claim of extracting the metal by a cheap process from the Sudbury ores, are true ; and I hope to succeed as well as I did with the New Caledonia ore, which I discovered and afterwards treated metallurgically by my processes patented February 20, 1876, in France. and March 20, 1876, in England. In that patent occur these passages :—

"I therefore expressly reserve to myself the employment of carburet of iron, iron, cast iron, and steel, allied with a variable proportion of nickel, according to the circumstances. The nickel which I add increases the qualities of iron both in respect of its strength, malleability and capacity of resisting oxidation.

"To obtain alloys of iron and nickel it is sufficient (and I reserve this point), to combine the carburets of nickel and iron in proper proportions in the various actual operations of the transformation of carburets of iron into iron, cast iron and steel. . . . . . I reserve the employment of what I call 'ferro-nickel' for the manufacture of gun-barrels, pieces of ordnance, knife blades, sabre blades, etc., and chains for naval purposes.

"It is clearly understood that in the various cases the proportions of nickel in the ferro-nickel will vary according as it may be desired to attain a higher or lower degree of tenacity, malleability and freedom from oxidation. By these alloys of nickel and iron I create, so to speak, a metal above or superior to the best "siderurgic products," a metal which attains the object so long sought for, of possessing at the same time a high degree of tenacity with great malleability, and but slight inclination to oxidation."—(Extracts from my English patents.)

Having been obliged by circumstances to transfer all my patents to the Nickel Society of Paris, I was unable to use them. The society made no use of them either, unless under the name of "Marbeau," my former associate in nickel business, who is a capitalist—neither chemist nor engineer. But my first patents have now expired, and having privately improved them in the interval, I hope now to enjoy the fruits of my sixteen years' labor.

JULES GARNIER.

PARIS, February 20, 1891.

Asbestos : Its History, Mode of Occurrence, and Uses.*

By R. W. Ells, LL.D., F.G.S.A.

To the casual observer it must almost seem like a practical application of the old saying about "Carrying coal to Newcastle," to attempt to give a lecture on asbestos, before the members of a society so thoroughly conversant with the features of this great industry as the members of the "Asbestos Club" are supposed to be. As, however, you have kindly invited me to deliver the opening lecture of the course which your association proposed to carry out, I will endeavor to place before you some facts pertaining to this mineral which may prove of interest, especially at the present time, when asbestos is assuming so prominent a place in the commercial and industrial world, more particularly as regards its origin, its distribution, composition and utility. But before doing so you must permit me to say a word or two in commendation of the enterprise which has led to the establishing of so important, and, it is to be hoped, influential a society as that which I have the honor to address on this occasion; an organization, which, I feel assured, if rightly conducted, will be a power for good in the land. So many new features are rapidly coming to the front in connection with the mining industries; so many improvements are constantly being made in methods of mining and in mining machinery by which hand labor is being rapidly superseded; so many changes in the mining laws and regulations of the several provinces are being carried out or contemplated, and so great are the changes in the mineral market, especially in the case of minerals so sparingly disseminated as asbestos, that a thoroughly organized body of men, intimately interested in all that pertains to the output, the economical handling, the shipment and ultimate disposal of this substance, is almost an absolute necessity. To a certain extent some of these points are doubtless intended to be met by the establishment of the newly organized General Mining Association of the Province of Quebec; but while that society should, from the influential position of many of its members, be able to do much good by calling attention to and correcting legislation which might be harmful to the mining interests of the province at large, and by the reading and publication of papers bearing upon special subjects connected therewith, there is, in a society such as you have so wisely inaugurated, in the very heart, probably, of the most important mining industry of this Province, much work equally as important to be done. Work of this kind, such as you should, I hold, look carefully after and take into your consideration, embraces not only the condition of the mines themselves, but the sanitary condition of your mining centres—often quite as important a branch of mining economy as the extraction of a certain number of tons of ore. Who, for instance, ten years ago, passing through this section of the country, one of the roughest, physically speaking, in the province, and, except from the mineral standpoint, of comparatively little value, would have thought that, in a very few years, such extensive mining villages would have sprung into existence. And yet you are only on the threshold of the industry. If the growth of your mining towns has been so rapid in ten years in the infancy of your development, what will it be in the next ten years, as your output increases, and when that output should have reached a five or ten-fold amount. Here then is where a club like this can make its power felt for good—viz.: in the establishment of strict sanitary regulations, in making due provision for the drainage, and for the moral welfare of the people under your influence and control; for if such provision is not made in time—and the sooner the better and easier—with the rapid growth of your town and the lack of a good water supply and proper facilities for the carrying off of the waste material for your population, you may certainly calculate upon the usual wretched experience of places which lack such sanitary appliances. Then there is the necessary protection against fire; in the construction of a complete fire system, the building of reservoirs for supply in case of sudden outburst, the obtaining of the necessary apparatus, and the placing of such fire-fighting appliances under proper management. What do you suppose would be the fate of the Village of Thetford should a fire break out at one end of the place, with a strong wind blowing though the street, in the dry time of summer? How much of the town would escape destruction, and how many thousands of dollars' worth of valuable machinery would be destroyed? These questions may not seem, in the present state of this industry, of great moment to us, but they are, I hold, of the utmost importance, and this club of mining men is the one institution which can, by judiciously consulting on these subjects, and by working together harmoniously and systematically, do everything to avert possible disaster in the directions specified.

Then there is the social and mental improvement aspect of such a club, one of very great value in a place like this, where men of intelligence are thrown generally into surroundings not the most congenial, and when, unless some such society exists, which provides for an interchange of thought and comradeship, the tendency is to retrograde. And this isolation is one of the strong objections to life in a mining camp. In the present case, however, fortunately there is no necessity for such a state of things. In this district are a number of men well educated and imformed, not only in the matters more directly pertaining to the work in hand, but in the wider sense men who in the exercise of their profession of mining engineers and mine managers are familiar with many foreign countries and have a large store of the most valuable and important facts, connected not only with the profession of mining, but of great general interest as well. In such a club as this there should never be a lack of subjects for discussion, nor a meeting which should not be full of interest, for there is, as a rule, no body of men, professional or otherwise, in which one will find, or ought to find, at least, so great a spirit of good fellowship or *camaraderie*, and so spontaneous a feeling of give and take, as among our brethren of the mining profession. As for their hospitality, that of the true mining man is too well known to require further mention, as personally many of us can testify not only for the mining centres of Black Lake and Thetford, but in many other portions of the Dominion.

The Eastern Townships of Quebec have for nearly half a century been known for their mineral wealth in some form; but the country west of the St. Lawrence must be given the credit of having had in active operation the first great industrial works in this Dominion. I refer to the long established iron smelting forges of the Three Rivers district. Presumably the gold of the Chaudière River next came into notice, and was mined quite extensively forty years ago by the DeLery and other companies on the tributaries of that stream, while the copper mines which in connection with the asbestos form the principal sources of mineral wealth at the present day for this portion of the province, were first brought into notice about the same date, though the era of development did not take place till near the year 1860.

The principal sources of Quebec's mineral wealth, east of the St. Lawrence River, are in the slates and schists of the Cambrian, and pre-Cambrian systems, which extend across the province in a north-easterly direction, following approximately, and at a considerable distance inland, the course of that river. In connection with the slates and schists, an important area of eruptive rocks, diorites, granites and serpentines, the latter not an eruptive rock in itself personally, but an alteration from some of the varieties of eruptive rock. To the schists of the pre-Cambrian or oldest series belong, for the most part, the workable deposits of copper at the present day, though copper mines have been opened in many places in Eastern Quebec in the slate beds or dioritic masses of the Cambrian as well. These, however, with rare exceptions, notably the Acton and Huntingdon Mines, have not been productive of copper in paying quantity, but have served excellently for the expenditure of capital.

The slates and associated quartz veins of the Cambrian are apparently the source or storehouse of the gold in Eastern Quebec, and it is in the slates of this formation, on the Chaudière and the Ditton, that our richest deposits of the precious metal are known to occur, destined some day, I believe, when the conditions admit of their development, to astonish the Canadian people with their value.

In the rocks of the same system, the Cambrian, on the slate quarries of Melbourne, Cleveland and Shipton, and in the same formation also, are found most of the outcrops of serpentine which are here known so widely as the containing rock of that peculiar mineral asbestos, a mineral of comparatively recent introduction regarded from the commercial standpoint, but which in the last ten or twelve years has come into such marked prominence in certain branches of manufacture.

The asbestos mines of the province of Quebec are, at the present day, of special interest to the mining and industrial world, from the fact that in so far as now known they practically represent the only deposits where this mineral, of a quality adapted for spinning and for the finer purposes of manufacture, can be profitably obtained. So great are the advantages which these mines possess, particularly as regards their accessibility and the ease with which the asbestos is extracted, that unless fields as yet unknown and as easy of access can be discovered, this province will doubtless long enjoy the position of being the principal source of supply for this peculiar and important substance.

The rocks with which the asbestos veins are associated in Quebec constitute a somewhat distinct series, which have, for the last thirty years, been known under the name of the "Quebec group." They comprise an extensive and important development of both sedimentary and eruptive rocks, which extend throughout the eastern part of the province, from the Vermont boundary to the extremity of Gaspé peninsula. They are not recognized in their entirety in any other part of Canada, though certain portions of the group are found in their extension southward into the United States. Crossing the Gulf of St. Lawrence they, however, form a very extensive belt in the island of Newfoundland, where, more particularly at certain points on the west coast, the same series of slates, sandstones, diorites and serpentines occur, the whole presenting features both from geological and mineralogical standpoints, very similar to what are seen in this portion of Canada. While these rocks in Newfoundland have, to a certain extent, been traced out, in so far at least as the entirely unsettled and unopened character of that section of the country permitted, no systematic search for asbestos has as yet been made, though that the mineral occurs there at a number of points and in a variety of forms is clearly indicated by the specimens which have from time to time been obtained in the course of the general geological exploration of the Island. Some of these specimens belong to the group of actinolitic minerals like the deposits found in Potton and Bolton, but among others observed from that country were samples of vein asbestos, equalling in quality any obtained at Thetford, and having a fibre from two to three inches in length. Little attention has, however, been paid to these deposits by the people of the island, and their extent is entirely, as yet, unknown. It cannot, however, be expected that this seeming indifference will long continue, in view of the rapidly increasing demand and consequent advance in prices. And it is probable that the time is not far distant when Quebec's greatest rival as a source of supply for asbestos will here be found.

While the mode of occurrence of asbestos, and, to a limited extent, its uses as well, have been known to a few, probably for the past twenty centuries, the discovery of its true economic value and of its great commercial importance are matters of quite recent date. Under the general term "asbestos," we find included several varieties of minerals, or of rock matter, some of which present startling and somewhat anomalous features. For instance, rocks as a rule, or the ingredients of mineral veins are generally regarded as possessing a weight or density several times greater than water, yet in one form, at least, of this mineral, we have a substance so light that it will float readily upon water, and has in consequence received the name of *mountain cork*. To most people, also, in speaking of rocks, minerals, or ores generally, the impression is conveyed that these are dense, heavy bodies, which can be crushed to powder with the proper application of sufficient force, yet here we have a mineral which can be pulled apart with comparative ease, teased out into fibre, and which thereupon presents the characteristic appearance of fine floss silk or cotton, so much so that in certain places this material is familiarly known by the name of cotton rock—or as the French call it, *pierre du coton*.

We have therefore here a substance which in some respects presents features belonging to both the mineral and vegetable kingdoms.

While, however, asbestos in all its forms must be styled a true mineral it possesses certain properties which distinguish it very clearly from many others. Among these presumably the most important is that of non-conductivity or its power of resisting the action of heat, in which respect it possesses some of the properties of wood, which also is in one sense a slow conductor, though in much greater perfection; since wood under the action of sufficient friction rapidly becomes charred and even ignited, whereas friction apparently exercises very little influence upon asbestos, no matter how long it may be applied. This property of non-conductivity, or of resistance to fire or heat, is one of the principal reasons for its extensive application in certain lines at the present day.

The term *asbestos* is derived from the Greek and signifies literally *inextinguishable*, while the other term frequently applied to the same mineral, viz., *amianthus*, is also of Greek origin and signifies *undefiled*, from the property possessed by the mineral of being purified by the application of flame without injury to the substance itself. This was a property well recognized by the ancients since we read in several of the earliest authors that the custom prevailed of wrapping the dead bodies of their important personages in an incombustible cloth by which the ashes resulting from their cremation were retained intact. The process of weaving this cloth from the fibres of amianthus shows that considerable scientific skill in the textile arts had been acquired by those people, judging from the difficulty which has been experienced even in modern applications of the art, and it is supposed that the requisite degree of tenacity was imparted by the admixture of threads of flax or silk, which could afterwards, if necessary, be removed by burning. The wicks of the lamps in the early heathen temples, which were supposed never to be extinguished, were also held to have been made of this material.

The resistant action of the asbestos fibre, or of the cloth woven from this fibre, to heat, is one of its most wonderful properties. Temperatures of 2000° to 3000° are easily withstood, while with some varieties a temperature of 5000° Fahr. has apparently produced no visible effect. Its property also of successfully resisting the action of acids is one of great value, and these properties render this substance of great importance in certain chemical operations, so much so that its use in this direction is rapidly increasing.

In addition to the cloth used by the ancients in the process of cremation, napkins were also woven and specimens of these are preserved in the museums of several of the cities in Italy. The old story of the table cloth of Charlemagne is doubtless familiar to many of you, in which it is stated that he used to draw this cloth from the table, all soiled with the *debris* of his feasts, and in the presence of his guests, throw it upon the blazing fire, from which it was soon taken, cleansed from all impurity. This peculiarity, however, probably applies to a cloth made from the true asbestos and not from the chrysotile, the difference in which will be pointed out as we proceed, but which varies from the other somewhat in composition. To the former variety, also, probably belongs the garment described in the story so quaintly given in the book by Montpetit, concerning the French *habitant*, in which he relates that at a certain lumber camp in one of our great northern forests, one of the men, newly engaged, upon his return from his day's work in the soft melting snow, when the rest of the crew were gathered about the stove, coolly proceeded to remove his boots, and then his socks which he dashed into the open fire. He, however, speedily extricated his foot gear, now cleansed to immaculate whiteness, and proceeded to dress his feet as if nothing unusual had occurred, a proceeding which, it is needless to say, among a group of people unaccustomed to witness such marvels, resulted in something stronger even than amazement, and with a sudden accession of terror at the presence of a man who could thus perform such miracles with apparently flaming garments, they incontinently fled and left the uncanny stranger undisputed master of the situation, under the impression that he could be no other than the evil one himself. Explanation was of no avail, and the men refused to return to work until the foreman had discharged absolutely the unfortunate wearer of asbestos socks.

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* Delivered before the "Asbestos Club," Black Lake, P.Q., Feb., 19th, 1891.

Somewhat analogous to this is the story related to me by one of the local managers of an asbestos mine in Coleraine township. This gentleman, also, was the fortunate possessor of a pair of asbestos mittens and under the impression that these were indestructible by fire, and desirous of astonishing the crowd which was gathered around the stove in a country store proceeded to throw one of them into the flames within. The success of the wished for miracle was not, however, equal to his expectation, since upon withdrawing his mitten from the flames, after a short interval, it was found that the action of the fire had rendered the fibre so brittle that its tenacity was almost entirely destroyed, and the mitten was of no further use. In order to explain, then, the seeming inconsistency between the two cases, it may be stated that what is known as the Quebec asbestos of commerce and the true asbestos, are two distinct substances, and belong to two distinct groups of minerals. Thus asbestos proper belongs to what is known as the pyroxene or hornblende group, while that obtained from the Quebec mines belongs to the talc or serpentine group. The former is classed among the igneous rocks proper, such as syenites, granites, porphyries, etc., and embraces, among other varieties, augite, diallage, hornblende, etc. Some asbestiform minerals are augitic, but the greater number belong to the hornblende family, and are known by several names, such as amianthus, asbestos, byssolite, tremolite, actinolite. In the variety known as pilolite, which is also a division of the hornblende group, several curious forms of asbestos occur, such as mountain paper and mountain leather, in which the fibres have become felted together in a somewhat uniform consistency, and are in the form of thin sheets; mountain or rock cork, which is a more massive form, and in which the specific gravity ranges from .68 to 1.34, and mountain wood, the name of which is derivable from its ligniform or woody aspect. The chemical composition of these several asbestiform minerals varies considerably, but for the most part they may be classed as silicates of alumina and magnesia, with varying proportions of lime and iron and occasionally a little water. The varieties known as mountain cork and leather contain a considerable proportion of water, amounting sometimes to 23 per cent.

A peculiar bluish variety known as crocidolite, and found in South Africa, Norway, and at several other points, contains a very considerable proportion of iron protoxide, sometimes as much as 35 per cent., in addition to silica, magnesia, and soda, and contains also a small percentage of water. This mineral is more properly a silicate of iron, and has great tensile strength as compared with the ordinary form of asbestos, though deficient in fire-resisting properties.

These minerals occur for the most part in serpentinous rocks in the oldest formations. In Canada, the variety known as actinolite occurs in large masses in the Laurentian rocks of Ontario, in the townships of Elzevir, Lake and Tweed.

It is also found in Norway and Sweden where rocks similar in age and character occur. The finer varieties of amianthus and asbestos occur most abundantly in the Alps of Savoy, near the boundary of Switzerland and Italy, and in the island of Corsica, at which places beautifully white silky fibre is found in considerable quantity along with much of the coarser varieties.

The variety known as tremolite is found in several countries, generally in the old Laurentian rocks, in connection with limestone. It consists of long prismatic crystals of white, grey and green colors, but has not the fine fibrous texture of amianthus or chrysolite, and it frequently graduates into actinolitic forms. It occurs in the Laurentians of Canada and New York where it has been mined for some years to a limited extent. Cork, leather, etc., are also found in rocks of the same horizon, and beautiful specimens of the former are obtained from the township of Buckingham, in Quebec. The preceding minerals belong to what is styled the group of the anhydrous silicates in which water is supposed, for the most part, to be wanting.

Of the other varieties, belonging to the talc and serpentine group we find water entering into their composition to a very appreciable extent, and they are therefore placed in the group of the hydrous silicates of magnesia. These include talc, soapstone, or stearite, potstone serpentine and a number of other kinds, somewhat similar but not economically important. The composition of all these may be generally stated to be silica, magnesia and water, with occasionally a little alumina and iron, the percentage of water, ranging from 2½ to 5, in talc, to 12½ and 15 in serpentine, so that the distinction between the two groups, the hydrous and the anhydrous, is, in this way, clearly marked. While the composition of talc, soapstone and serpentine is to a great extent the same, or with the ingredients in slightly varying proportions, the mineral which we call asbestos in Quebec, but whose true name is chrysolite, is confined almost entirely to the latter. The serpentine itself is frequently of varying colors, being green, grey, red, yellow and brown, having a hardness of about 3 to 3½, and a specific gravity of 2.5 to 2.7. It is generally massive, but sometimes presents a banded structure and is occasionally quite slaty, being frequently marked with spots, veinings and stripes of various colors. The coarser fibrous varieties are known as picrolite and baltimorite; the fibres themselves being devoid of the soft silky character and lustre which is a peculiarity of the better kinds of the variety known as chrysolite or the asbestos of commerce.

Asbestos is therefore seen to present a great variety of forms, and in some one or more of these it is found at various places over the greater part of the surface of the globe. Among these may be mentioned in Europe, small deposits in England, Scotland and Ireland; in France to a limited extent, except in the extreme southeast in Savoy, more abundantly in Italy and Portugal, and on the island of Corsica, where the beautifully silky variety, amianthus, is quite abundant. In Germany, Bavaria, the Pyrenees, Russia, Norway and Sweden deposits of greater or less extent have been found.

In south Africa the peculiar bluish variety, crocidolite, has already been referred to, and recent reports state that extensive deposits of asbestos occur in the serpentine belts of Kimberley, in which the diamond diggings also are situated. Asbestos has also been found in South America, in Brazil, in Australia, and in Asia Minor. In several parts of Newfoundland, excellent fibre, more particularly of the variety known as chrysotile, is known to occur, and in the United States it is also found in connection with the serpentinous rock of the eastern mountain range in nearly every State from Maine to Georgia. On the west coast also it is reported in considerable quantity from California and British Columbia, and as far north as Alaska, while its presence in the rocks of Ontario and Quebec has been recognized for many years. With such a widely extended distribution, therefore, it would seem natural that the supply of the material should be practically unlimited. Such, however, does not appear to be the case; since in many of these places the quantity is so small as not to be available for general use, and in others the quality is such as to be economically valuable only for the inferior purposes of manufacture; while in others again the difficulties of access preclude all possibility of successful mining, for years to come at least. Prior to 1880, the greater part of the fine fibre adapted for spinning came from the mines of Italy and Corsica, and owing to the difficulty with which it was obtained and its exceptionally fine quality commanded a very high price in the market, reaching as much as $250 to $300 per ton; but the discovery of the chrysotile deposits in the Province of Quebec, of a quality equally well adapted for spinning as that of Italy, taken in connection with the fact that these were situated directly along a line of railway within short haulage of a shipping port, almost revolutionized the industry, and has lately nearly closed the Italian mines.

Much of the so-called asbestos of these mines, however, is not adapted for spinning, and is used for the manufacture of mill-board, cements, paints, etc., as is also the output from such mines in the United States as have been working more or less constantly for the last twenty years. The output of the Quebec mines has even already had such an effect upon these that their present output is probably scarcely one-tenth of what it reached ten years ago.

In Ontario, also, a large quantity of the variety known as actinolite is mined and ground at Bridgewater in Hastings County. This is used for cement roofing, being mixed for that purpose with tar, the fibrous texture of the material being sufficient to allow of its felting sufficiently, but not for spinning.

The non-conducting substances available in the process of manufacture in addition to asbestos are not numerous. Among the most important, probably, may be mentioned *infusorial earth*, which is generally found as a white or a grayish white earthy material occupying the beds of certain lakes, or under peat bogs, and in deposits frequently of very large extent. In composition this earth is almost a pure silica, and is composed of the siliceous shells or crusts of diatomaceous plants, spicules of sponges, etc. It is also known as tripolite, and under the name of *Tripoli*, or polishing powder, is familiar to most housekeepers. The localities where infusorial earth occurs most abundantly in the States are in Virginia, where an immense bed, many feet thick, underlies the city of Richmond; and in California, where a deposit of fifty feet in depth occurs near Monterey. In Germany large deposits also are known under the name *kieoelguhr*, and much of this material used in the United States comes from that country. Numerous lake bottoms filled with this substance occur in the provinces of Nova Scotia and New Brunswick, generally of much greater purity than the American or German earth, and it is also found to some extent in the Province of Quebec.

It is extensively used for the manufacture of water glass or soluble silica, and for the coverings of boilers and steam pipes, for which purposes, owing to its great non-conductive properties, it is especially adapted. As a polishing powder it is also extensively employed, and for some years was an ingredient in the manufacture of dynamite, as an absorbent of the nitro-glycerine which enters into the manufacture of this explosive. For this purpose, however, wood-pulp has now to a large extent superseded it. In the lining of safes and for the protection of exposed portions of buildings, it is also largely used, but it can never compete with the asbestos fibre in the peculiar processes to which that product is now applied.

Another non-conducting material which enters largely into competition, both with asbestos and infusorial earth, is the substance known as *mineral wool*. This is an entirely artificial preparation, and its discovery was doubtless due to the fact that a somewhat similar substance occurs in a state of nature in connection with certain volcanic eruptions, more especially in those of the Sandwich Islands, where the slaggy volcanic liquefied matter is acted upon by blasts of air and blown out into long silky fibres, which have received the name of "Pele's Hair." Mineral wool, or slag wool, is formed artificially in a somewhat similar way, viz., by subjecting a stream of molten slag from a blast furnace to a jet of steam or compressed air, by which means the slag is broken up into minute particles, generally with a small fibrous end or tail, which accumulate as they fall and resemble masses of roughly teased out cotton. The solid particles which form the head of each minute atom are subsequently detached, and the finer fibres carried over into a separate chamber, when they are ready for use. This material possesses wonderful properties as a non-conductor of heat or sound, has great lightness, and is absolutely fireproof. It is extensively employed as a material for covering boilers, steam-pipes, and for lining buildings to render them fire, sound and vermin proof. While, therefore, it competes very successfully in many points with asbestos as a non-conducting substance, like infusorial earth it has not the property of being spun, and has also several objectionable features besides which interfere somewhat seriously with its universal application.

Steatite or soapstone is an excellent resistant of heat, and as an ingredient in fireproof paint is probably quite as valuable as asbestos, while as linings for stoves, furnaces, etc., it has long enjoyed a well deserved reputation. It also enters into competition with asbestos as a loader or filler of paper stock, and for several other purposes to which the lowest grades of the asbestos waste were formerly applied, but its special use at the present day would appear to be the manufacture of a non-corrosive and fireproof paint.

As non-conductors of heat and sound several other preparations have been invented, among which may be mentioned *wood-pulp* and *terra-cotta lumber*, the latter being principally a mixture of clay and sawdust, made into bricks like ordinary clay. This mixture possesses great lightness, especially fitting it for interior work, such as dividing walls in buildings, being both fire and sound proof, but can scarcely be said to be a rival or competitor of asbestos in many respects.

Having thus briefly reviewed the several asbestiform and other non-conducting substances, we can now proceed to the consideration of the asbestos or chrysotile deposits as they occur in Canada, and more particularly in the Province of Quebec, since it is in this province that the most important developments in this mineral have taken place.

The workable asbestos of Quebec is, in so far as at present known, confined to the serpentine areas of the mountainous belt which extends through the Eastern Townships from the boundary of Vermont to the extremity of Gaspé peninsula, with the exception of certain peculiar deposits which are found in connection with the serpentinous limestones of Templeton and the Gatineau valley in the Laurentian rocks north of the Ottawa. Concerning these latter deposits sufficient development work has not yet been done to determine definitely their economic value, but the quality of fibre obtained from some of the asbestos veins of this district is remarkable for its purity or freedom from foreign substances. The serpentines of the Townships form a series of disconnected masses, generally of small extent, surrounded by igneous rock, principally dioritic, but occasionally rising through great outcrops of slates or schists. At times these serpentinous masses assume such proportions as to rank almost as mountain ridges, as can be seen in Wolfestown and Coleraine, and in Gaspé in certain parts of the Shickshock range. As pointed out last year in an excellent paper "On the Serpentines of Canada," contributed by Mr. N. J. Giroux, of the Geological Survey, to the Ottawa Field Naturalists' Club, these peculiar rocks are found in formations of different ages from the Laurentian to the Tertiary. To the latter period some of those found in British Columbia are supposed by Dr. G. M. Dawson to belong, while others are there associated with rocks of Carboniferous age. It is evident, therefore, that they have a very wide geological range; and this is seen, also in the province of Quebec, where the serpentinous limestones north of the Ottawa are of Laurentian age, while the serpentine east of the St. Lawrence is associated with rocks of Huronian, Cambrian, and possibly even newer systems. Whether this difference in the age of the serpentine formations may have any influence on the question as to the presence or otherwise of asbestos in workable quantity is a question not yet fully ascertained, but there is some reason to suppose that the serpentines of a certain age are more productive of chrysotile in paying quantity than that of more recent date in this country, in the same way that the quartz veins of the Cambrian rocks appear to be the seat of more productive gold mines than those found in newer formations.

The serpentinous rocks of New Brunswick have not as yet yielded asbestos except as mere thread-like veinings. These are found to belong to the Laurentian system. In Nova Scotia it has not yet been recognized, but recent investigations in northern Ontario, according to the report of the Royal Mining Commission for that Province, lately published, indicate the presence of fibrous asbestos in the vicinity of Lake Temogami, according to the statement of Mr. E. Haycock, in veins of considerable length. This is in rock also supposed to be of Huronian age.

The serpentine areas of the Eastern Townships may be divided into three portions, viz.: 1st, a southern, embracing the masses in Potton, Sutton, Bolton, Orford, Melbourne and Shipton, which terminates not far from the Shipton Pinnacle, south of the village of Danville, though occasional detached outcrops appear above the surface for a few miles further north; 2nd, a central portion beginning with Big Ham mountain and extending through the townships of Ham, Coleraine, Thetford, &c., to and beyond the Chaudière River, in which the most conspicuous and important masses are in Thetford and Coleraine ; and 3rd, an eastern area which is found in the Shickshock range of Gaspé and of which the most eastern outcrop is in Mount Serpentine, on the Dartmouth River, about ten miles from Gaspe Basin.

While all serpentine rocks present certain leading features which enable them to be readily recognized by anyone familiar with their general aspect, there are in the serpentine of these three areas several marked peculiarities which serve to distinguish them quite easily. Thus the rocks of the southern area are frequently, though not always, slaty, and occur sometimes with much soapstone, or potstone, and sometimes with dolomite, and have frequently a greasy smooth aspect on the slaty surface. About Brompton Lake they are associated with great hills of dioritic rock as well as with slate, and contain masses of white garnet. Mining has been attempted at several places in these rocks, more particularly for ores of copper, which has produced some very fine hand samples, but in so far as yet worked, not in quantity to be remunerative. Veins of asbestos are seen occasionally, but these are as a rule of short fibre, either soft and pasty, or harsh and stiff, while in extent they are mostly short and gashy, and do not possess the well defined vein character of those seen in Thetford and vicinity. Near Danville, however, in a peculiar knoll-like mound of serpentine the veins of asbestos are well developed, and fibre of very fine quality and of suitable length for spinning is found in abundance. The occurrence of this mass of serpentine, rich in asbestos, in a belt which is well developed a short distance to the south, but which is there, in so far as yet prospected, almost deficient in asbestos fibre of any length, is peculiar, and serves to indicate that, even in most unlikely places, exceptional development of conditions may give place to a favorable change in the rock which may lead to the establishment of a profitable mining area.

In so far, however, as experience has determined the conditions for profitable mining, the serpentine of this southern area does not yield indications favorable to successful development ; and the same remark will apparently apply to much of the serpentine found in the adjoining State of Vermont. It is possible that much of this serpentine may be the result of alteration from dolomitic rock, or from slates which contain dolomite ; whereas it is clear that much of that found in Thetford and Coleraine is an alterative product of dioritic eruptive rock, rich in olivine or some allied mineral.

The rocks of the central or Coleraine area differ as a whole from those just described in being, as a rule, much more massive, and occurring in large areas. They have associated with them deposits of chromic iron and of magnetite, as well as of asbestos. Large areas of steatite or soapstone occur also about Ham Lake, and mining for nickel was carried on in this vicinity many years ago, the quantity of this mineral obtained being, however, but small. The country occupied by these rocks is generally rough and uninviting from the agricultural standpoint, and the whole area from Ham Mountain to the northern terminus of the main belt in Thetford or at the Bull Mountain in Adstock is of this description. In character of rock the serpentine presents several varieties. Portions are hard, reddish brown weathering and very siliceous, as seen in much of that in the townships of Wolfestown and Ireland, and even in the Coleraine ridge south of Black Lake and about Lakes Caribou and Little St. Francis. In this hard siliceous serpentine, asbestos very rarely occurs, and when present is mostly of imperfectly developed fibre in short and gashy veins. Occasionally, however, seamy partings are found which at first glance and at a distance, present somewhat the aspect of asbestos veins, but on closer examination reveal the existence possibly of a small parting of fibre, or sometimes only of a seam of serpentine. In certain portions of the belt these seamy partings are quite numerous, and by some prospectors are supposed to indicate the presence of workable veins, on the general principle held by many practical miners, that a vein of mineral matter always becomes larger as it is followed downward, a principle of such peculiar application that its absurdity should be apparent to anyone who has ever thought a moment on the subject.

Passing beyond or to the north-east of the great masses of serpentine in Thetford and Coleraine, detached masses, knolls, and sometimes bands of this rock crop out at intervals. These are well seen near the Chaudière River, both in the Bras de Sud-Ouest and in the Des Plants streams ; but though these outcrops have been carefully prospected, nothing more than small gash veins have been found. Further to the north-east on the south side of the great dioritic mass called Moose Mountain in Cranbourne, a small outcrop of serpentine, on the bank of the Etchemin River, shows small veins of one quarter to possibly half an inch of fibre, and this is the most northerly outcrop of asbestos-bearing serpentine yet known in this belt.

The most easterly area, viz., that of the Shickshocks, is largely made up of serpentine, different in character from the rock of Thetford, which we may take as our typical locality ; the southwestern portion being very hard and siliceous, in contact with black hornblende schists on the north ; while the eastern or Mount Albert serpentine, which is the principal area in this direction, is frequently banded with shades of reddish brown and green. In these rocks only small veins of imperfect fibre have yet been found, and the generally hard and siliceous character of much of the rock is against the presence of large deposits of the fibrous variety. In the most easterly exposure, on the Dartmouth, the serpentine is very much of the same nature as in the Shickshocks, associated with hornblende schists and containing small veins of one-quarter inch fibre of but little economic value.

It is easily seen, therefore, that the character of serpentine which is really asbestos-bearing to an extent which can be profitably worked, is confined to a comparatively limited area, and more particularly to certain portions of the townships of Thetford, Ireland, Coleraine and Wolfestown, in which localities successsul mining operations have been carried on for some years. But even in these favored districts there are large portions of the serpentine belts which, in so far as yet proved, have disclosed no asbestos in quantity to be economically available. The rock carrying the merchantable asbestos is generally a greyish weathering serpentine of some shade of green on fresh fracture, generally a greyish green, in which are contained numerous small particles of iron, both magnetic and chromic, more generally the former. Serpentines that have a black, hard, chippy aspect do not apparently promise well, nor does the rock which weathers a dirty reddish brown. In the asbestos-bearing rock proper the veins of asbestos are seen, without any special arrangement, intersecting the mass of the rock generally in every direction, but for the most part at a considerable angle both to the perpendicular and horizontal. Certain peculiar arrangements of these veins are, however, noted in certain areas, as at the King Bros.' mine in Ireland, where the serpentine appears to be regularly stratified almost in the manner of sandstone or quartzite in layers dipping to the northwest, and the veins of asbestos apparently follow what, in sedimentary rocks, would be regarded as the bedding planes. In several other places the veins, few in number, cut the rock in an almost horizontal position, and when found in a knoll can be traced across from one side of the hill to the other nearly on the same plane, but as a rule the veins are irregularly placed. In size they range from mere threads up to a thickness of five or six inches, though the most of the workable veins in the principal mines do not, or but rarely, exceed two and a half inches in width or length of fibre, and such veins, where the asbestos is of good quality and unbroken by partings of iron, are regarded as extra No. 1 material. There are, however, generally, more small veins of one inch or less than of the larger size. Serpentines associated with talc or with soapstone, where the latter is in quantity, rarely appear to carry veins of asbestos to any extent, and such steatitic rock is not usually considered good mining ground. The Broughton mine may possibly be cited as an exception to this principle, since at this place a vein of large size of very fine fibre was found lying between serpentine and soapstone walls. As the soapstone became more abundant, however, the size of the vein rapidly became less and finally split up into small strings and became useless, and it is a fact worthy of note that at the great and profitable mines in Thetford and at Black Lake soapstone is absent from the rock mass.

As for the origin of these veins in the serpentine several theories have been advanced. In composition the vein matter is, as already mentioned, apparently the same as the containing rock, and the chrysotile is simply a fibrous serpentine. Some have supposed the veins to be formed when the mass of the rock was in a pasty state and exposed to sundry strains or twistings which produced the fibrous nature of certain portions. That the rocks have been exposed to such violent action is very evident from their present faulted character. Others have supposed the cracks to have been formed by the cooling and shrinking of the mass from a heated and pasty state by which cracks have been formed, which subsequently became filled with asbestiform matter from below. In whatever way the fissures were caused, and it is very probable that they have been formed by the great processes of metamorphism to which the rocks were exposed in the change from dioritic matter to serpentine, the vein asbestos appears more naturally to have been produced by a process of segregation of serpentinous matter from the sides of the fissure, very much as ordinary quartz in many mineral veins is known to have been produced, the segregated or infiltrated matter gradually filling the original fissure, and meeting at or near the centre, in proof of which the presence of a comb of particles of iron is very often found occupying the centre of the vein, and quite frequently these iron grains assume sufficient size as to form a regular parting of iron ore in the fibre. In this respect asbestos veins resemble very closely mineral veins with quartz or calcite which frequently contain alternate layers of ore on either side of a central comb of crystals. The arrangement also of the fibre at right angles to the sides of the containing fissure, except where the rock has been disturbed, is confirmatory evidence in the same direction.

In some of the mines fibre of exceptional length is observed. Sometimes there are veins caught along lines of fracture and drawn out of their natural position. At other times this long fibre is, to some extent at least, due to the friction of the rock walls by the displacement of a fault. In this way the long woody fibred material, known as hornblende to the miners, but which is rather a form of picrolite, is probably produced. In the same position also, and due probably to the same cause, are the long well fibred strips of asbestos seen in some of the mines, and which at first sight might almost be taken for vein matter of exceptional length. A very peculiar form of asbestos is found on an island in Lake Nicolet, where also the coarse picrolitic variety is well seen, which consists of small concretionary pellets of asbestos containing a nucleus of serpentine and enclosed in a steatitic rock. This peculiar development was first pointed out by Mr C. W. Willmott, and has not been recognized at any of the other mines, at least to a noticeable extent. But a still more peculiar form is that seen at the Megantic mine in Coleraine, where the serpentine wall for the distance of several feet is laced with minute veins of not more than a twentieth of an inch in thickness, and presents the appearance, on fresh surfaces, of a rock regularly and evenly striped with greyish white paint. The same mode of occurrence of small veins is seen at King Bros.' mine in Ireland, and at Bellmina, and occasionally some of these smaller veins there come together and form one of workable size. This peculiarity is also conspicuous in the serpentine asbestos deposits of Templeton and the Gatineau district, although the character and age of the containing rocks are entirely distinct from those of the eastern area. In this latter place the small veins of asbestos have a thickness generally of an eighth to a fourth of an inch, with partings of light greyish serpentine of about the same thickness. These occur throughout a space sometimes of a foot or even possibly more, and enclose roughly lenticular masses of limestone, which are often of large size. Sometimes several of these detached veins coalesce and produce a large vein having a thickness of two inches of wonderfully clear fibre, which continues for a short distance and then splits up again. The same peculiarity is seen in the lower part of the large vein at the Broughton mine in eastern Quebec, where the hanging wall is soapstone.

While, therefore, indications of asbestos or chrysotile may be found at most places where serpentine rocks occur, it is, I think, very clearly established by the work of prospectors, as well as by that of the staff of the Geological Survey, that very many areas do not contain, nor are likely ever to produce, asbestos in workable quantities ; and while the greatly enhanced price of the mineral renders operative, areas which a few years ago could only be worked at a loss, it must be borne in mind that the great profit is made in the output of first-class material, rather than in third-rate asbestos. To any person, therefore, contemplating investment in such mining areas, it is plain that the first thing to be attended to is a careful examination of the property by one not personally interested in the matter, and one, further, who has a good knowledge of the different kinds of serpentine, as well as of the conditions which should govern the occurrence of asbestos in sufficient quantity to repay the money invested. Unfortunately prospectors as a class, not only of asbestos properties, but of other minerals as well, are not sufficiently well informed as to such conditions. Many are led by what they have observed in connection with mines in certain other areas, such as for instance in the case of the Cornish miner, who measures everything in a Cornish half bushel. Whereas the truth is that the profitable or economical development of minerals very frequently depends upon the presence of local phenomena or conditions which have affected certain limited areas only of the earth's surface or crust. Just what the conditions have been in the past by which the serpentine areas of Thetford and Black Lake have become so impregnated with asbestos veins of great purity and large size, while the areas a short distance to the east or west should be almost devoid of asbestiform mineral, cannot yet be conclusively settled. It is possible that the presence of the large intrusive masses of granulite, which are of more recent date than the serpentine, may have had some effect in this direction, but in that case we should expect to find at Black Lake, where these granitic masses are the most abundant, the richest deposits of asbestos. On the contrary, however, it is found that the largest and most important veins are found at Thetford, where the granitic masses are comparatively small and generally confined to narrow dykes ; for while the serpentine of this area is, according to the best testimony on the subject, due to an alteration of igneous or dioritic rocks, we can scarcely suppose that the asbestos itself is of igneous origin. While, therefore, the reason why the Thetford areas are the most productive of fine asbestos fibre has not yet been satisfactorily ascertained, we have been able to learn some facts from the study of these Thetford mines, which are of value to guide the prospector or the scientific explorer in the search for other deposits.

Since the asbestos veins occur throughout the mass of the rock and come directly to the surface where exposed, as in the hill at Thetford mines and the great escarpment to the south east of Black Lake station, the mining of the mineral does not follow the methods which are usually employed in the working of other mines, viz., by underground slopes and levels connected with the surface by shafts, but is simply open quarry work, the entire rock being removed, broken up, and the veins of asbestos separated by hand cobbing, in so far as the size of the veins will warrant the expenditure of labor for this purpose. The bulk of the barren serpentine necessary to be removed in order to obtain a ton of fibre is consequently very great, and while no exact data are to hand by which the relative proportion of asbestos and serpentine can be determined, it has been estimated to range in the ratio of 25 to 1 in very prolific ground, to 50 to 1 in ordinary mining. Of course in such a great quantity of waste rock, under the present system of working, many small veins or portions of veins are not removed, owing to the expense and difficulty attending such operations by hand labor only—and the great heaps of waste material have accumulated till they now occupy large areas of valuable ground. As in the case of the drilling and hoisting, however, where hand labor has been obliged to give place to steam and compressed air, so, also, very shortly the breaking and cobbing must also be done by machinery, and with proper appliances, with a great saving of expense, as has resulted in the case of the drilling and other operations ; since with a properly equipped mine the cost of production can be reduced from 50 to 75 per cent. from the expense due to the laborious system of hand labor.

The history of asbestos mining presents some points of interest in view of the rapid growth of the industry. Comparatively little importance was attached to the mineral, from the economic standpoint, in the early days of the Geological Survey's operations, and this combined with the fact that, although asbestos had been known before 1850 in the serpentines of the Eastern Townships, the quantity seen at the places where discovered was very limited, and led to the result that but little heed was paid to its occurrence. In 1877, owing to the burning off of the forest in Thetford and Coleraine townships, the hills of serpentine became laid bare and the weathering speedily produced the peculiar felting of the asbestos fibre on the surface wherever veins occurred. This was observed by a French-Canadian named Fecteau, it is stated, and the importance of the new material was soon ascertained, which resulted in the establishment of mining operations on a small scale in the summer of the same year, by the Johnson's Asbestos Mining Company, although the credit of the first attempt at working should probably be given to the Ward Brothers. The areas in the immediate vicinity were speedily secured and new mines located, since which time the growth of the industry has been constant and rapid, the output increasing from 50 tons only in 1878 to probably not far from 8,000 tons in 1890, while the prices have also advanced within the last year or two at a like wonderful rate, till now No. 1 Quebec asbestos commands probably as good a price in the market as the best Italian, while No. 3 brings nearly as much as was obtained for No. 1 six years ago.

According to the Ontario Commission's Report, actinolite mining in that province was commenced in 1881, since which time about 3,000 tons have been extracted. This material, however, does not command the price of the Thetford mineral, selling at about the same figure as the waste or No. 4 from that locality, it being used almost entirely for asbestos roofing, for which purpose it is mixed with tar, as already stated, and then applied in a coating of about half an inch in thickness. The waste from the mines of the Eastern Townships, and formerly the output graded No. 3, was at one time quite extensively used for the same purpose.

The asbestos of Templeton was probably first mined in in 1883, but the industry has never proved very remunerative, owing to the limited nature of the deposit and the smallness of the veins, so that for some years mining was entirely abandoned. During the last season, however, operations have been started anew, and some very excellent fibre taken out, it is claimed at a profit. The conditions under which the asbestos occurs in this district are distinct from those which are found both at Kaladar in Ontario and in the serpentine areas of the Eastern Townships, the serpentine in which the asbestos veins occur being intimately associated with crystalline limestone, and in many places the latter is highly serpentinous. The fibre of the asbestos is distinguished from that of Thetford in having a marked pearly and wavy lustre, in being generally lighter colored, and by an entire absence of impurities in the form of iron grains. Sufficient study of these peculiar rocks has not yet been made to pronounce definitely upon their probable importance, but when the deposits are made more accessible considerable mining will be done, as these appear to be quite extensive.

As for the uses of asbestos, these have multiplied with exceeding rapidity. The early history has been briefly stated, in so much that sufficient acquaintance with its peculiarities had been learned many centuries ago to enable it to be woven into cloths often of considerable size. At the present day the finer grades and longest fibres are still somewhat extensively used for weaving into cloths, from which drop curtains for theatres, suits of clothing for firemen, and various other articles, are made, among which are asbestos mail bags for railway transit. So important is the matter of fire protection in theatres now regarded in the leading cities of Europe and the United States, that special legislation has decided that asbestos curtains of a size sufficient to completely shut off the stage from the body of the house must be a part of the stage furniture. As an instance of what can be woven from this material, it may be mentioned that the curtain of the Academy of Music, Philadelphia, by which the stage is separated from the body of the house in case of fire, is 54 feet wide and 53 feet high, and is made almost entirely of pure asbestos, only 3 per cent. cotton being employed, presumably to facilitate the weaving.

As a protection for firemen asbestos clothing has been proved to be of the greatest advantage. By its aid they have been able to enter burning buildings and approach so closely to the flames as to extinguish them in a much more speedy manner than by the old plan of fighting them at a distance. Of a somewhat similar character are the fire shields, also made of asbestos, which are placed between the burning building and those who are fighting the flames, thus protecting them largely both from the great heat and from the dense volumes of smoke as well. As for the great heat which can be endured when clad in these garments, the story of the extinguishing of the Coste gas well in western Ontario only last year is quite fresh in our memories. Here the huge jet of gas which issued from the stand-pipe of the well became ignited, and the screw-cap which closed the pipe having received some injury could not be adjusted so as to effectually close the orifice. Several expedients were resorted to in order to arrange the cap successfully, till at last, under promise of a heavy reward, some one, clad in an asbestos suit, boldly approached the flame itself, a thing absolutely impossible without the protection thus afforded, adjusted the cap properly, screwed it on and extinguished the ignited gas. But while the use of this material for the purpose of clothing has steadily increased within the last ten years, so many other needs have arisen to which it appears especially adapted, that the manufacture of clothing is forced to take a comparatively unimportant place. Thus in chemical laboratories fine asbestos cloth, or even finely teased out asbestos fibre, is now used very extensively for filtering various solutions for which no other material yet discovered has been found so well adapted, especially for strong acids and alkalies which would quickly destroy the ordinary filtering paper. The advantages of the asbestos filter are also apparent in the fact it can be ignited without being consumed. It is also rapidly coming into use in sugar refineries for filtering the saccharine juices, and as a filter for water it has been found to possess vrey superior qualities over most of the substances in use, and will doubtless, before very long, become an important agent in the purification of our supply of water in large cities.

Its value as an ingredient in the manufacture of fire-proof paint has already been alluded to slightly, in which respect it ranks with steatite. Applied to woodwork it is capable of successfully withstanding a very considerable volume of flame and so confining the fire to a limited space. As a material for fire-escapes also, owing to its very considerable tensile strength, it is largely made into rope, the fibres of which are sometimes strengthened by the addition of brass or copper wires, from which ladders are then made, which are practically indestructible. More recently, also, its properties as a non-conductor of electricity have been discovered, and a great demand has sprung up for it in the construction of dynamos, and other portions of electrical apparatus requiring insulation. Wall paper, also, printed in ornamental colored patterns, which when applied to the walls of a room reduce the risk of conflagration to the least possible degree, are manufactured even now in considerable quantity, and even writing and fine printing papers are made which have the property of resisting destruction by fire, and though becoming altered to some extent, even then preserve the writing or printing which has been made on them. A great difficulty, however, in the former case is to give the paper a sufficiently hard and smooth glossy surface over which the pen can glide freely ; but this defect will doubtless be remedied in time, and with a fire proof ink the preservation of deeds and important papers can thus be readily effected.

To those affected with cold feet a stocking or insole of asbestos cloth, which is easily made, is a sure preventive of discomfort. This article has already been manufactured by an enterprising firm and a patent taken out theron, while a thin strip. used as a cork sole, will be found highly efficacious in keeping one's feet comfortable. While, however, the uses to which this peculiar mineral appears to be adapted are manifold, possibly the most important and valuable is that to which it is now so generally applied, viz., as packing for cylinder pistons in steam engines, and for joints in gas, steam and hot air pipes. In the manufacturing of steam packing good fibre is required capable of spinning. The mineral as it comes out of the rock in vein form is first pulled apart and the fibre teased out into a woolly or silky mass. Then, by specially prepared machinery, the gritty and iron particles are carefully eliminated, since their presence would be productive of injury to the rapidly moving polished piston rods, and the resulting product, a fine fluffy substance, is then carded and spun into yarn or woven into cloth.

If the former, the yarn is treated after the manner of manilla and manufactured into ropes of various sizes and shapes, as required for the different varieties of packing into which it is to be made. In order to adapt the mineral to special uses the fibres of the asbestos are frequently intermixed with fine wires of copper or brass or associated with rubber. In some varieties also finely divided graphite enters into the composition, presumably to impart greater lubricity to the material. The great value of this packing arises from the fact that it is unacted upon by steam or heat, and consequently retains its elastic properties for a very long time in comparison with the old style of hemp or rubber packings ; so that now, especially since the late improvements in engines of the marine type where enormous power is developed, such satisfactory results could not probably be obtained by any other known substance.

As a covering for steam pipes and boilers it has also come into very general use, the saving in fuel and power from its application far more than repaying the cost of the material, and is estimated to be not less than 30 per cent. of the energy developed.

But it would be practically impossible in a paper of this kind to enumerate the uses to which this wonderful material is now being applied, and concerning the adaptability of which fresh discoveries are being made almost daily. The great importance attached to the deposits in the province of Quebec is seen in the fact that several of the largest companies interested in the manufacture of asbestos products have found it to their interest to secure mines of their own in this district, among which may be mentioned the Bell's Asbestos Co. and the United Asbestos Co., of London, Eng., and the great German firm of the Wertheims, of Frankfort, while American firms are also largely interested in several of the mines. In spite, therefore, of the wide geographical distribution of the mineral, it is evident that the asbestos of this country has, from its excellent qualities and from the ease with which it is obtained, risen to this prominent place, and in view of the fact that the sources of supply appear to be limited, it is doubly important that in all mining operations the minimum of waste should be permitted by the employment of the most improved machinery applicable to the purposes of mining and dressing, consistent with its economical and profitable output. This view of the case is now rapidly engaging the attention of those who possess the keenest insight into the great possibilites of this industry, and rapid strides have taken place in this direction during the last two years.

I trust that sufficient has been said in this paper to show that in asbestos we have a substance which is almost unique in the mineral kingdom—a substance of such ready adaptation to such a variety of uses that its neglect for so many years seems wonderful to those who have but superficially glanced at the subject. Doubtless, however, the great expense attendant upon its use prior to the discovery of the deposits of Thetford and Coleraine, in Quebec, is largely accountable for this state of things, and as in the case of many other substances when once they have come into general use, one wonders how the manufacturing and commercial world ever got along without them. It is possible that within the capacious bosom of mother earth there are stored up other treasures of the mineral kingdom whose uses are also unknown at the present day, but which await the fortunate coming of some clever genius to show their great importance. A very striking case in point is seen in the enormous nickel deposits of Sudbury, and, to go a little further back, in the great petroleum wells and the reservoirs of natural gas of Canada and the United States. In fact nature seems to delight in astonishing us at intervals with the production of some new material which almost revolutionizes the existing methods of work ; yet it is equally certain that, just as soon as these substances are discovered, the inventive genius of man proceeds to find out some process by which they can be utilized. It will not do, however, to conclude absolutely that, because asbestos at the present day appears to fill a want which is apparently incapable of being filled by any other known material, this condition of things will continue forever or even for any very great length of time. Scientific investigation in the various branches of manufactures and arts is progressing at so wonderful a pace that one ceases almost to be astonished at each successive and brilliant discovery. It is gratifying to know, however, that all such discoveries, whether in the domain of medicine, electricity or in any of the branches of applied science tend to the increased welfare, comfort and advancement of the human race, and to those engaged in the solution of the problems which are constantly being presented in the different fields of scientific research, the thanks of all men are due as to the world's greatest benefactors.

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Examination of Mines.[*]

By Prof. H. S. Munroe.

(Continued from page 33).

FORMATION OF MINERAL DEPOSITS.

The engineer should, of course, be familiar with the literature of ore deposits, and fitted by practical experience in mining operations and by training in field geology to make an intelligent examination of the deposit.

The engineer should not be too hasty in his generalizations, and should bear in mind that similar deposits may have widely different origin, and even that parts of the same deposit may be due to different causes. Deposits of magnetic iron in some cases may be altered bog deposits, or metamorphosed beds of carbonate of iron, originally of chemical origin ; in other cases they may be purely mechanical deposits concentrated by the action of running streams,[†] or again, in other cases, it is possible that they may have been formed by replacement, or deposited from solution in cavities and fissures, or part of the deposit may be due to one cause and part to another, as at Iron Mountain, Missouri.[‡]

In the examination of a mineral deposit the engineer should be careful to observe and to record his observed facts without bias or prejudice in favor of one theory or another. He should form his conclusions with great care and deliberation. A theory is of value mainly as a means of bringing disconnected facts into some kind of arrangement, so that they can be studied, and is useful only so long and so far as it accounts for the phenomena observed.

In no department of mining engineering is there greater opportunity for brilliant professional success; and in none has failure from hasty and crude generalization proved more disastrous.

MEASUREMENT OF DEPOSITS.

In the case of coal seams and similar deposits, the volume of mineral within the limits of the property may be computed with great accuracy. The areas of coal within the lines of outcrop may be determined by measurements on the map. The surface and underground explorations should give data to estimate what part of this area may be regarded with safety as workable. The average thickness will be obtained from numerous measurements.

A seam of coal of 1.3 specific gravity will contain about one hundred and thirty tons per acre for every inch of thickness. For other densities multiply the specific gravity by one hundred. Allowing for pillars and waste in mining, the common practice of estimating one hundred tons per acre per inch of thickness, approximates very closely to the probable yield.

In irregular coal basins, as in Pennsylvania, the volume of mineral is obtained by developing the warped surface graphically and multiplying the areas thus obtained by the average thickness,[*] or the method suggested by Mr. R. P. Rothwell may be used, and the horizontal area underlaid by coal multiplied by the thickness of the bed or beds measured vertically (instead of normally to floor or roof as above).

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[*] School of Mines Quarterly.

[†] H. S. M., School of Mines Quarterly, vol. iii., p. 43.

[‡] The "Iron Mountain Mine," Prof. W. B. Potter, Am. Inst. Mining Engineers, New York meeting, September, 1890.

MEASUREMENTS OF IRREGULAR DEPOSITS.

Metalliferous deposits as a rule are much less regular in thickness than coal seams. Certain precautions should be taken to secure accurate results. When the variations in thickness are great the prismoidal formula[†] may sometimes be used to advantage and limited portions of the deposit computed separately. In other cases the average thickness may be used. To obtain this accurately the measurements averaged should be as nearly equi-distant as possible, and greater weight should be given to measurements on a mid-section, than to those on the boundaries. The determination of the average thickness, and the areas required by the prismoidal formula, will be facilitated by carefully constructed cross-sections of the deposit.

Sometimes the thickness to be considered is modified by special conditions. For example, the vein may be very thin and yet workable, as is often the case in gold and silver mines, and in rich deposits of the other metals. In such cases the width and height of the workings will be constant and independent of the thickness of the mineral, as enough broken rock will have to be mined to enable the men to enter and work.

In like manner when the ground is traversed by well defined fissures parallel to the vein, it may be necessary to mine the barren rock up to this fissure in order to make the workings safe.

Again, where the vein or bed is split and the portions are separated by a "horse" or "parting" too thin to be left standing, it may become necessary to mine this rock with the ore.

In all such cases the mining and handling of this barren material must be taken into consideration, and the necessary measurements made, so that its amount and its effect on the average richness of the material mined may be determined.

DETERMINATION OF WORKABLE AREA.

In the case of a uniform and persistent bed, horizontal or slightly inclined, the total workable area may be assumed to be that contained inside the outcrop and within the property lines. If the bed lies at an angle, allowance must be made for the inclination.

In the case of a bed or vein dipping at a high angle we may have another limit, that fixed by the maximum depth at which the mine can be worked with profit.

In the case of less regular deposits, the workable area within the above boundaries, that is, the proportion of this total area that can be profitably worked, must be more or less a matter of uncertainty until the workings actually traverse the whole area. This, in most cases, does not occur until the deposit is nearly exhausted and the knowledge is of little practical value.

Sometimes we can form an estimate of the relative areas of workable and unworkable ground from that portion of the deposit which is exposed by the exploratory workings. A careful study of these developed portions of the mine will often reveal the laws governing the distribution of the useful mineral so that the future may be predicted with some confidence. Estimates thus made may be sufficiently trustworthy to be applied to the undeveloped portions of the mine.

Variations in thickness and in richness or quality of the mineral are often sudden and unexpected. Large barren or unworkable areas are liable to occur, or the deposit may come to an abrupt end. The estimates of mineral in undeveloped portions of the mine and the values deduced therefrom are of necessity speculative. This should be made very clear in the report on the property. The value of an engineer's estimate of the speculative value of the property, as opposed to the wild guesses of interested and over-sanguine parties, has been pointed out.

ORE "IN SIGHT."

In the case of very irregular deposits, isolated ore-bodies, lenticular masses, chamber deposits, bonanzas in veins and similar deposits, the continuance of which in depth is uncertain, it is unsafe to estimate on more mineral than that proved to exist by the exploratory workings. Many engineers prefer to take this course in all cases, and estimate the value of the mine from the mineral "in sight." The term mineral "in sight" is variously interpreted by different engineers, but can be defined as the mineral which can be proved to exist, the nature and amount of proof necessary varying with the character of the deposit.

In most cases, the mineral to be "in sight" should be exposed on at least two sides by workings more or less parallel and not too far apart. For example, the coal between two parallel gangways; the mineral between the uncovered outcrops and an underground level; or the ore between two inclined shafts in the vein.

It is not safe to estimate on mineral exposed on one edge only, as the edge exposed may chance to lie along the boundary of large unworkable areas.

The workings should not be so far apart as to leave chance for unworkable ground between.

To lessen the chance of unworkable areas within the body of ore "in sight," many engineers demand that at least three sides shall be exposed by workings. For the same reason it is well to connect the parallel workings by others at right angles, winzes, cross-headings, etc., and thus divide the deposit into rectangular blocks exposed on four edges. This will be a necessary preliminary to working the deposits in any case, and has the added benefit of securing better ventilation of the exploratory workings.

When a portion of the deposit is exposed on two adjacent sides only, *e.g.*, by a shaft and a drift, or by the outcrop and a shaft or a drift, it is customary to estimate as "in sight" the triangular area bounded by the workings in question and a straight line joining the ends of the same.

SAMPLING AND ASSAYS.

The samples required for assay to determine the quality or richness of the mineral should be taken at numerous points, and so taken as to represent the average value of the deposit at each point. When different benches or different zones of the deposit vary in richness or in quality, the samples from such sub-divisions may be taken separately at each place.[*] Different benches of a bed of coal may differ greatly in character, amount of ash, of sulphur, of volatile matter, etc. It is not necessary or desirable, however, to subdivide the samples taken, unless the benches can be kept separate in mining.

With the above exceptions, the samples taken at any one place should represent the whole deposit, from foot to hanging-wall.

In coal and soft ores, a uniform groove for this purpose is cut with a pick or with a hammer and moil, across the face of the deposit.

If the material is harder, one or more blasts may be fired with light charges of explosive, so as to break up and shatter the face without completely dislodging the fragments. Chips and splinters may now be broken from the loosened fragments which are still in place, or as they are taken down, so as to give the required average sample.

If the deposit is very wide and uniform, samples may be taken at intervals from foot to hanging-wall instead of in a continuous groove.

If the mine is being worked, samples should be taken from the mine-cars, from the dumps and stock piles, as a check on the results.

The conditions under which the sample was taken, the manner of taking and the amount of ore represented by the sample, should be noted in every case.

SALTING.

The engineer must use due precaution to detect and guard against fraudulent practices. If a sufficient number of samples be taken underground, and these be taken arbitrarily, and not at points suggested by interested parties, successful "salting" will be made more difficult. Such preparation of the mine is generally on a small scale and at few points. A thorough sampling of the mine makes it necessary to do the work of salting on a large scale. Careful examination of the deposit at the selected points, before taking the samples, will generally detect the fraud.

A more dangerous practice, and one more difficult to guard against, is the salting of the engineer's samples during the process of sampling, or subsequently. Sealed bags and boxes are not always sufficient protection against this form of fraud, as the sample may be "doctored" with strong solutions of the precious metal. It is possible again to prepare a mine for examination by concealing the poorer portions of the vein with timbering and loose rock, leaving exposed the richer stopes and treadings only, suspending the work in those places when and where the showing is best.

When fraudulent practices are suspected, the engineer should advise the leasing of the mine by the intending purchaser with privilege of working for six months or a year, in which time the fraud, if any, will be exposed.

EXAMINATION OF PARTLY EXHAUSTED MINES.

A mine that has been worked for a number of years is a less valuable property in exact proportion to the amount of mineral that has been mined. Such a mine, however, has been thoroughly proved, and much of the mining risk attending the development of a new property has been removed. A well developed mine, for this reason, usually commands a much higher price in the market, even though a large part of the deposit has been exhausted. The examination of a partly worked property will be conducted on the lines above laid down for a developed property, with the following additions:—

1. An examination and survey of the abandoned workings as far as accessible.
2. A study of the history of the mine, total yield, average richness of the ore, etc.
3. Investigation of details of working, cost and profits.

The survey and examination of the old workings will determine what reserves of rich or low-grade ore exist in the form of pillars. The examination and survey will also show the condition of the abandoned workings and how far the safety of the whole mine may or may not be endangered. If there is danger of a general crush, or if the shafts or main gangways of the mine are threatened, the cost of making the mine secure must be estimated.

Finally, this examination and survey of the old workings will furnish data from which to estimate the total amount of material excavated, which, with the measurement of the waste rock in the dump-heaps and underground, will serve as a check on the statements as to ore treated or shipped, and will show what proportion of barren material has to be mined with a given amount of ore.

Finally, the underground survey will show what area has been mined and the proportion of available ground remaining.

It will frequently happen, especially in old mines, that the abandoned workings will cave in, or are inaccessible, so that the survey above outlined cannot be made or can be made only in part. In such cases, the necessary information often can be obtained from existing maps and other sources, and the desired estimates of area, if not of volume, can be made.

The history of the mine, its total yield, the cost and profits of mining etc., should be obtained by examination of the mine books, of official reports, the books of transportation companies, of smelting works; and from such other sources as may seem reliable. From this material, it should be possible to obtain the total production of the mine, the average cost and yield per ton, the average selling price and profits; and such other data as will be of service in estimating the value of the mine, and the probable profits of working.

Finally, a careful investigation should be made of the methods of working and of the details of management, that possible improvements and sources of economy and of increased profits may be indicated.

EXAMINATION OF ABANDONED MINES.

The re-opening and working of abandoned mines is attended with more than ordinary mining risk, and the examination of such properties demands great care and good judgment. The larger and more important the mine, the longer it has been worked and the more ore it produced, the greater is the mining risk.

The mine, in any case, is partly worked out and is by so much the less valuable; and it is possible, and in most cases probable, that the deposit is practically exhausted.

Even in the most favorable cases, the cost of re-opening the mine will be very great, and usually will be more than the cost of opening and developing a new deposit. The mine must be drained of water—in itself an expensive operation. The shafts and drifts must be re-opened and generally re-timbered. As it is quite likely that the pillars and arches have been robbed before the mine was abandoned, much of this work will be through fallen ground and very expensive. Finally, the hoisting engines, pumps and other machinery, will have to be repaired or replaced.

As it is probable that the work of exploration and development was suspended some time before the mine was finally abandoned, so it is probable that much exploratory work will be necessary to prove the existence of valuable mineral.

It is not probable that any part of this expense of re-opening will be paid by mineral extracted.

Finally, the working expenses will be greater than in a new mine, especially in the items of drainage, tramming and hoisting, and timbering.

There are cases in which the mines may have been left in more favorable conditions and in which the risk of working will be less.

In countries liable to political disturbances, mines have been abandoned during war time and not subsequently re-opened. In the western mining regions the ravages of hostile Indians have had a similar result.

Mines are sometimes temporarily abandoned because the conditions were unfavorable to success. Situated in remote regions, the cost of the transportation of the necessary supplies and of the products of the mine may have been too great to allow of profitable working. Or again, on account of the undeveloped character of the region a market for the product may have been lacking, or may have been so remote as to be unavailable. With the construction of railroads and the development of the country, such mines can often be re-opened and worked with profit.

Finally, it often happens that mines worked with insufficient capital, or under bad management, are abandoned, and later under more favourable auspices they are re-opened and yield large profits.

The examination of an abandoned mine is one of the most difficult problems likely to occur in the practice of the mining engineer.

It is probable that all the available ore has been taken out, and that even the pillars have been robbed before the mine was abandoned. There is no ore "in sight," and little or nothing left to give an idea of the average value of the deposit. Before the closing of the mine it is probable that the advance headings, shafts, drifts, etc., were suspended, one by one, as the prospects became less favorable. Nothing but poor ground is likely to be found. Finally, the workings are probably under water and inaccessible.

Under such circumstances it will not be advisable to go to the expense of draining the mine until a preliminary examination has been made. In this preliminary examination the engineer must depend almost entirely on the past record of the mine. The evidence, however, is likely to be fragmentary and incomplete; the books in all probability have been lost or destroyed, and but little documentary evidence remains. The engineer will be forced to collect such information as he can from trustworthy sources, and weigh the evidence carefully before submitting an opinion.

Even after the mine is drained a final examination and report cannot usually be made until the mine is developed to a certain extent by exploratory workings.

In the work of re-opening an abandoned mine the greatest care should be taken at each stage of the operations to minimize the mining risk by limiting the expenditures at any one time to such amounts as the prospects of success seem to warrant. At first the explorations should be in one or two places only; later, if the developments are favorable, a larger force may be employed and the opening of the mine may be pushed more rapidly. Permanent improvements which may be necessary for active work should not be undertaken until there is sufficient mineral "in sight" to warrant the expenditure.

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[*] *Second Geological Survey of Pennsylvania*, Report A. A., p. 107. Also, "A new Method of Mapping the Coal Fields of Pennsylvania." *Trans. Am. Inst. Mining Engineers*, February, 1881.

[†] See *Trautwine's Pocket Book*, p. 160, and *Treatises on Railroad Surveying.*

[*] See paper by D. H. Browne, "Distribution of Phosphorus in the Ludington Mine" *Trans. Am. Inst. Mining Engineers*, vol. xvii., p. 616.

SCALE OF OPERATIONS.

The proper scale of operations is determined mainly by the size of the deposit, and by the probable life of the mine. In certain cases the market for the product, and the effect of a large production on the selling price, must be taken into account.

The size of the deposit limits the scale of operations chiefly by limiting the number of men and machines that can be profitably employed.

The shape of the deposit also has its influence. For example, a lenticular mass, narrow and thin in proportion to its depth, like a bean-pod suspended by one end, cannot be worked continuously on a large scale, as there will be room for but one or two working parties on each level. Worked rapidly, one level will be exhausted before the shaft can be sunk to the next.

A regular bed or vein can be worked from several shafts and on several levels at the same time. A large working force can be employed and the scale of operations will be limited only by the size of the property and the amount of capital.

The thickness of the deposit limits the working force at each point of attack and the amount of mineral which can be broken at a single blast. The total value of the deposit, and the probable yearly profit, limit the amount of capital that can be employed (and consequently the scale of mining operations) by determining the amount upon which interest can be paid, and which can be extinguished by a sinking fund during the life of the mine.

The degree of mining risk involved will limit the amount of capital that can be safely invested with any prospect of its being returned to the investor before the mine is exhausted. The uncertainty as to the continuance of a deposit is a maximum in the case of an undeveloped property; so it is especially important to proceed cautiously at the beginning of a mining enterprise, and by working on a small scale at first, limit the amount of capital subject to risk of loss. Later, when the work of exploration has shown a reasonable certainty of several years' supply of mineral, a larger amount of money may be risked, and the work of development pushed more vigorously. In exceptional cases, the mine will itself furnish the necessary capital.

With the exceptions and limitations above noted, it may be stated as a rule, that the scale of operations should be as large as possible, and the mine worked as rapidly as circumstances will permit.

The advantages of rapid work on a large scale are the following:—

1. The cost per ton of mineral is less. There are certain fixed expenses, such as pumping, ventilation, superintendence, taxes, office expenses, etc., which are nearly the same whether one ton or one thousand tons be mined per day. Again, it is cheaper to work the plant to its full capacity. For example, in the case of a hoisting plant, the same number of engineers, firemen, bank-men, bottom-men, etc., have to be employed, whether one hundred tons or one hundred and fifty tons be hoisted.

2. Rapid work decreases the cost of maintaining the shafts, gangways and levels, of renewing timber, of removing falling ground, etc.

3. More capital is required for work on a large scale, but the amount does not increase in the same proportion as the output. The capital is redeemed in a shorter time, and the total interest charge is very much less.

The Mining Prospects and Industries of West Algoma.*

HENRY DEQ. SEWELL, D.L.S.

HISTORY OF THE MINES.

Mining on the north shore of Lake Superior is of a comparatively recent date, which is somewhat remarkable as there are numerous evidences of mining by the aboriginal inhabitants in Isle Royal, where old workings, in which were stone hammers and other crude implements, have been found. The honor of the first mineral discovery on the North Shore was, however, reserved for Colonel Prince, who, in 1845, whilst searching for copper at Spar Island in Prince's Bay, found a vein of grey copper ore carrying a high percentage of silver. In 1846, Professor Sheppard was employed by the Montreal Mining Company, to explore and locate mineral lands along the North Shore, resulting in the taking up of twenty-seven large blocks of land, and some islands near them, but no mining work was done on them at that time, principally owing to the extreme difficulty of reaching Lake Superior with supplies, there being then only small boats on the Great Lakes, and these were only available as a means of transit for about six months in the year. From this time hardly anything was done until May, 1865, when the McKellar Brothers discovered the Enterprise mine, in the Township of McTavish, of galena ore carrying lead and silver; and in the year following they found the Old Thunder Bay mine in the Township of McGregor, containing native silver and argentite, and the Shuniah or Duncan mine, in the Township of McIntyre, also containing native silver and argentite. From this date, 1866, commenced the first boom in silver mining in Algoma district, which drew a large number of American capitalists to Port Arthur (then called Prince Arthur's Landing), resulting in large tracts of land being surveyed. The discoveries were frequent and rich until 1868, when a man named Morgan, in the employ of the Montreal company, discovered the Silver Islet vein on a small rock included in the company's land. In 1868 also a large deposit of baryta was found on McKellar's Island, but nothing was done of any importance with it until the past year, when considerable quantities of baryta were taken out and shipped to the United States. The vein is about 40 feet wide and of excellent quality. The next important discovery was in 1870, when Silver Harbor or Beck mine in McGregor Township, Pie Island and Cloud Bay were brought to light. Native gold was first found at the Huronian mine in the Township of Moss and at Partridge Lake in 1872. Considerable work has been done on the Huronian mine, and a ten stamp mill has been erected, but although there can be no reasonable doubt as to the value of the mine, still it is so difficult of access that it will not pay to work until it is reached by the Ontario and Rainy River R.R., when the author believes it will become a good dividend paying mine. With the termination of 1872 came the end of the boom or second period of the mines. Mining on the American Continent was as yet a very crude science, and of the experts who came to Port Arthur in those days but few understood their business; miners were paid exorbitant wages, and the general idea seemed to be to put up expensive buildings, and to drink champagne. When to all this was added the heavy cost of transport by the Great Lakes, it is to be little wondered at that one by one these promising mines expended their money and shut down, with the single exception of Silver Islet, which continued operations until March, 1884, when mining operations came to a close for want of coal to supply the pumping engines. The mine by that time had attained a depth of 1,230 feet, and had yielded from first to last about $3,250,000. That one mine, under able and skilful management, has been able to present such a wonderful record, would lead to the belief that some of the other silver mines were capable of producing valuable results, had they been as skilfully managed. Their failure is, therefore, much to be deplored as, once a mine is closed down, there exists a considerable difficulty in raising it again to a working basis, especially as such a result can rarely be obtained except by a change of ownership and the formation of a new company. After the close of the second period, in 1872, there appears to have been but little interest taken in mining enterprises until 1882, when Rabbit Mountain was discovered by Oliver Daunais, a trapper, who was shown it by an Indian. The extraordinary richness of this mine again revived the dying interest in Algoma silver mining, which has resulted in the discovery and working of the Beaver, Badger, Silver Mountain East, and Silver Mountain West, besides numerous other claims which have been more or less developed, and many of them with very encouraging results—such as the New Thunder Bay mine, Crown Point Palisades, Big Bear, Elgin, Silver Fox, and the Ottawa mines, which are amongst the most promising. The New Thunder Bay presents the novelty of being the only vein that contains chloride of silver, added to which it has unexceptional advantages for cheap mining operations. In 1884, the Zenith mine, containing zinc-blende with 58% of zinc, was discovered about 8 miles north of the mouth of Steel River, on the north shore of Lake Superior, about 6 miles east from Rossport, on the C. P. R., where some test pits were sunk and a large quantity of ore taken out. This mine could undoubtedly be sold and profitably worked, but the owners, like the dog in the manger of the old fable, will neither work it themselves, nor allow others to do so.

Many veins containing zinc-blende have been found in West Algoma, but the difficulty is to obtain zinc-blende carrying a sufficient percentage of zinc. A single discovery of mica was also made in 1885 on Dog Lake, but it has not been considered of sufficient value to be even surveyed. Iron was known to exist throughout a large portion of West Algoma, but nothing of any importance was done in this direction until 1885, when the author surveyed an extensive magnetic iron property on the Attic Okan River for Messrs. Graham and Horne. In the year following the author also surveyed a large tract of iron lands, chiefly hematite ore, but containing a percentage of magnetite, on Hunter's Island, and since that time very considerable areas of iron lands have been taken up both on the Lower and Attic Okan ranges.

Native copper, it is strange to say, was never found in paying quantities in West Algoma until the summer of 1889, when some large deposits in the shape of veins were discovered in the neighborhood of Cloud Lake in the Township of Crooks. To complete this abbreviated history of the mines of West Algoma, it may be desirable to give a short account of the gold mines or, rather, gold prospects on the Lake of the Woods, where so far there has been literally no attempt at legitimate mining, the discoverers appearing to consider their bare discoveries worth a fortune without making any attempts to develope them. Amongst these was the Pine Portage, which was discovered in 1880. After going down about 100 feet and putting up a 10 stamp mill, it was abandoned although the prospects were most encouraging. The Winnipeg Consolidated was discovered in 1881, a shaft was sunk 135 feet, when it was shut down owing to the company getting into litigation. Near this on Hay Island is the Partridge Nest or Keewatin, consisting of two good looking veins, 3 to 4 feet wide, which intersect each other at the water's edge. A little development has been done. It is a fair prospect, and free gold can be readily panned from the surface dirt. The Sultana, also near Pine Portage, is a promising property, carrying free gold in paying quantities. It is somewhat remarkable that all these discoveries have been made within a limited area which could be covered by an ordinary township of 36 square miles in area. A few other discoveries have been made, such as Gold Hill, Minerva, and a location of Oliver Daunais on Clearwater Bay, but it is problematical whether any discoveries outside the Pine Portage circle or block will ever pay to operate, though of course it is within the bounds of possibility that some of them may prove exceptions to the general rule, and turn out paying mines. One thing is, however, certain, that mining operations on the Lake of the Woods will be extremely limited and confined to a very small area unless some entirely new field is discovered. Gold in paying quantities appears generally to be found only in contact veins, occurring between the Laurentian and Huronian formation, whereas this condition does not appear to be necessary in the case of silver bearing veins in West Algoma. Last fall several deposits of nickel—which has long been known to exist in the district—were discovered at Schreiber, which are fully as rich as the Sudbury ores.

THE SILVER ISLET MINE

Is situated on a small rocky islet about a mile out in the lake, off Thunder Cape, in the Township of Sihly. The vein strikes N. 35° W., and dips to the S. E. at an angle of 70° to 80°, averaging in thickness about 8 to 10 feet, varying in some places from 20 to 30 feet of solid vein. The gangue of the vein consists of calcite, quartz and dolomite, the latter varying in color from cream to pink, according to the amount of manganese. It carries native silver, argentite, galena, blende, copper and iron pyrites with marcasite; it is also said to contain rodochrosite, tetrahedrite, domeykite, and niccolite, and cobalt bloom, and a peculiar mineral called macfarlanite, containing arsenic, cobalt, nickel and silver. Two new minerals, called by Dr. Wurtz, huntelite and animikite, have also been found in the ore, and the latter three were in 1881 the principal silver ores of the mine. The rock on the Islet intersected by the silver vein is a chloritic diorite forming a dyke. It differs somewhat from the rocks of the other dykes of this locality, amongst which may be mentioned corsyte and anorthite porphyry. The mine attained a depth of 1,230 feet before it was closed down for want of coal, and it was then still yielding silver. The total yield from first to last was about $3,250,000. Numerous attempts have been made to trace out the vein but without success until last summer, when a vein was discovered on Edward's Island, 9½ miles from the islet, averaging from 3½ to 4 feet in width, and which is supposed to be a continuation of the famous Silver Islet vein. It crosses a series of hornblende porphyritic trap dykes, each one of which has faults, and it has been traced across the island; a well defined outcropping shows on the north point of the island. The gangue of the vein in the shaft is composed chiefly of calcite with some quartz and baryta, heavily mineralised with galena, blende, iron and copper pyrites and nickel. At a depth of 20 feet a seam of arsenical silver and nickel came in and is continued down as depth is attained. Selected samples assayed from 40 to 130 oz. of silver to the ton. The shaft is now down to the level of Lake Superior, and is making 30 barrels of water daily. The vein is in many respects similar to the Islet. The same graphite dyke and again macfarlanite have been found, together with rich minerals of cobalt and a peculiar discovery, native arsenic in all its forms, crystalline and reniform or shelly. This arsenic contains a varying amount of silver, from a few ounces to many hundreds. The arsenic in itself is not new, but where it has been weathered by exposure the skeleton of native silver stands out on the black arsenic in mossy or dendritic masses of beautiful appearance. It seems this vein was known to the Indians who resorted there for medicine, carefully hiding the place on leaving, which perhaps may account for this vein not having been found before.

THE OLD THUNDER BAY MINE

Is situated in the Township of McGregor, not far from the eastern limits of the Township of McIntyre. The vein strikes N. 34° E., and dips at a high angle to the N.E., and consists of closely reticulated veins of white granular quartz, the largest being about one inch thick, and the aggregate average perhaps ten feet long. It carries native silver and argentite, accompanied by galena blende and iron pyrites. The ore occurs in bunches three to eighteen inches thick by six to forty feet in length, the silver being in strings, leaves, grains, &c., irregularly distributed through the vein stone which constituted the greater part of the bunch, the silver often forming ten per cent. of the mass. The work done consists of four shafts sunk on the vein, and a cross cut driven N. W. at the 10 fathom level and some drifting between the two deepest shafts. No. 1 shaft is about 70 feet deep, No. 2 is the same depth, 300 feet north-east of it, whilst 150 feet further on is another shaft 35 feet deep, and again, 150 feet to the north-east on the strike of the vein, another shaft has been sunk to a depth of 25 feet. A very considerable quantity was taken out of this mine, but much of it was stolen, so that it is difficult even to approximate the amount. Unfortunately in addition to this the mine was mismanaged from the first, but, had it been otherwise, it is thought by many that it might have even rivalled the Silver Islet mine.

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* Paper read at the annual meeting of the Dominion Land Surveyors, February, 1891.

THE SHUNIAH, OR DUNCAN MINE,

Is situated in McIntyre Township. The vein strikes nearly east and west, and has a general dip to the south at a high angle from the horizontal. The total width on the surface is 20 or 30 feet. Several cross lodes intersect or run into the main vein. The gangue is quartz, holding small quantities of galena, blende, and pyrites, and also calcspar. There is no pink spar as at Silver Islet, but there is a considerable amount of purple amethyst. The formation of the enclosing rocks is almost precisely similar to that of the Old Thunder Bay mine. There was a considerable quantity of silver taken out of it, but mismanagement resulted in the vein being lost, and it has been estimated that when the mine was shut down that they were fully 400 feet off the vein.

THE BECK, OR SILVER HARBOR MINE,

Is situated in McGregor Township, further east than the Old Thunder Bay Mine. The vein runs E.N.E., dipping at a high angle to the N.W. It has a brecciated character and is about 5 feet thick. The gangue consists mostly of white granular quartz, but barite, calcite, fluor and amethyst are present with much iron pyrites, galena and blende. The silver occurs mostly as argentite, but also in the native state. The country rock is much the same as Old Thunder Bay mine, and consists of smoke colored cherts and argillaceous shales, running nearly horizontally under what appears to be a bed of coarsely crystalline trap. The junction of the Animikic and Huronian lies about half a mile to the north of the mine. The vein showed a considerable quantity of silver at a depth of 40 feet, but it was badly mismanaged and was shut down without ever having had a fair trial.

THE "THREE A" MINE.

This property hardly deserves the name of a mine. The vein strikes N. 75° E., and dips slightly away from the vertical. It is from 18 inches to 2½ feet thick. The gangue is mostly quartz with a little calcite, through which are irregularly distributed ores of iron, copper, lead, zinc, nickel and silver, with some cobalt and gold. The ore was very rich, and samples assayed 1.4% of cobalt and 25% of nickel. The silver was however very pocketty, and eventually played out after about $2,000 worth of ore had been taken out.

JARVIS ISLAND MINE

Is situated westward of Silver Islet. Considerable work has been done on it. It runs across the island in a north westerly direction, and dips N.E. at 50° to 55°, thus contrasting with the nearly vertical dips of the veins on other islands. Three shafts have been sunk, respectively 160, 31 and 78 feet. Unfortunately it appears to have been mined solely because of its proximity to Silver Islet, which it somewhat resembles, both with regard to the vein matter and enclosing rocks, with the single exception that it is almost barren of silver. It has always seemed to the author that it was a great pity that so much money was wasted on a comparatively barren vein whilst numerous more promising veins have remained untouched. This, however, happens in almost every mining district, and it is a wonder that the selections in Port Arthur district have generally been uniformly good.

THE ENTERPRISE MINE

Is situated in the Township of McTavish, in Black Bay; the vein is six to eight feet wide, the gangue being quartz and calcite, with a pay streak 3 to 4 feet wide of galena and copper pyrites, with a small quantity of gangue. Prof. Chapman gave an assay from a selected specimen: lead 47 per cent., copper 8 per cent, silver $4 per ton. Owing to there being but little demand for lead at that time, this mine was shut down, but now with the probable demand for galena ores to assist in smelting the silver ores of the Beaver and Silver Mountain districts, it is likely that more attention will be paid to the lead ores of this district, especially as there are one or two promising properties, notably the "Ogema," situated in the northern part of the Township of Dorion, which contains a purer galena with a larger percentage of lead and silver. This part of the country has, however, been but little explored.

RECENT DISCOVERIES OF THE NORTH SHORE.

Although not in the order of discovery, a brief account may here be given of the explorations which have taken place during the past two years over the lands on the north shore of Lake Superior. These researches have been carried on principally on the lands of the New Silver Islet Co., and also in the neighborhood of Cloud Lake in the Townships of Crooks and Pardee, and consist principally of copper, although some silver has been found near Maimainse on the North Shore. The district is one vast bed of native copper ores, the geological structure being similar to that on the south side of the Lake in the Keweenaw district. This belt carries amygdaloid and conglomerate lodes and veins and sandstone. The great upheaval of nature manifest in the structure of the country has lead to a great diversity of opinion regarding the degree of mineral wealth possible in such a formation and during last summer there has been found no less than twelve distinct veins of rich copper, of which number eight are rich enough to form as many distinct mines of a most promising character.

The dip of the country is at an angle of 22° to 33°, and the trend of the strata is southeast and northwest, inclining more northward inland. The strata of the veins run north and south, cutting at angle of about 40° to 45°. The ores found are those known as the horse flesh and the peacock, gray ore and native copper.

These discoveries are all made on the lands belonging to the Silver Islet Mining Company, who own 10,000 acres in that vicinity alone, besides immense tracts of other valuable mineral land in the western section of Algoma district. So thoroughly have the American mineral men informed themselves of the natural resources of the north shore, that they have acquired possession of these grand deposits, while Canadians have held them to be a "God-forsaken country full of barren rocks." It may also be interesting to note that in this section have been discovered several articles of antiquity, such as ancient hand made pottery, ornamented with indentations of the thumb and thumb nail of the potter, copper hammers and other rudely constructed tools and implements of a long-since forgotten race of miners who came from no one knows where. But, like the traces left by these early miners at Isle Royal, and other places along the shores of Lake Superior, it shows that Maimainse did not escape the keen eyes of the copper hunter of those early days, who may have forgotten more about that section of country than the whole of Canada has as yet been able to learn.

With eight richly laden veins of copper in sight and half as many more of a lower grade ready for operation, the Silver Islet Company will begin work next spring for developing some of the long-hidden wealth. Maimainse is 12 miles west of Batchewanin lighthouse, and about 40 miles west from the Sault.

In the neighbourhood of Cloud Lake in the Townships of Crooks and Pardee, a number of copper bearing veins have been found during the past two years. They occur in bands of amygdaloidal trap which carries the metal in a fine state of division of native copper. The country in the neighborhood of Cloud Lake is high and hilly, rising up to a height of 300 feet, and consists of the black slates of the Animikic formation heavily capped with trap sometimes to a depth of nearly 50 feet. Average samples of copper ore from this locality assay as high as 12 per cent. Silver bearing veins have also been found in this locality and some of them have assayed well, so that there is every prospect that it may develope into one of our most promising mining fields.

RABBIT MOUTAIN MINE.

With the discovery of this mine in 1882, mining in this district came once more to the front after a lapse or rest of ten years (the natural result of inexperienced, and, one may almost say dishonest mining).

The conditions of this group are somewhat different from former discoveries in being further removed from the northern boundary of the formation and from the outcrop of the lower siliceous division. They are all in the upper argillaceous division with its associated trap sheets, the argillites being soft and black.

The vein of the Rabbit Mountain strikes N. 35° 45′ E., and dips at an angle of about 65° to 70° to the N.W. The vein is a composite one consisting of a number of branches and stringers interlaced and is about 4 to 6 feet thick, although much wider in places. The ore consists of native silver and argentite, accompanied in considerable quantity by blende with a little iron pyrites and galena, and occasionally copper pyrites in a gangue composed of quartz, calcite and green and purple fluorite. A good show of rich ore was found on the surface, and caused considerable excitement in the district. Several shafts were sunk on this property, and a stamp mill erected with a capacity of 15 tons per diem. Capt. McComber, who was manager in 1886, claimed that the concentrates ran as high as $4,000 to the ton, and averaged $1,500, the milling ore averaging $80 to the ton. In addition to this a considerable amount of ore was rich enough to be shipped in barrels, parts being almost pure silver. Although more silver has been taken out of this mine than would repay the entire expenditure, the mine was closed down in the fall of 1887, owing to a disagreement amongst the owners, with the view of freezing out some of the weaker owners, and from that date this very promising property has remained idle.

BEAVER MINE.

The next mine of importance is the Beaver, which was discovered shortly after Rabbit Mountain, and work was commenced in 1884. The work was continued on a small scale until it was sold to an American capitalist in 1885. Two veins have been worked in this mine. The main vein cuts in a N. W. direction across a ridge about 200 feet high, having a steep bluff to the N. W., whilst it is intersected about 300 feet in from the face of the ridge by a cross vein running in a north easterly direction. The cross fissure is very irregular and hard to follow, varying from a few inches to almost nothing. It was followed for about 350 feet, but as it carried but little mineral it was left. The main vein averaged 4 feet. The gangue of the vein consists of yellow and dark colored blende with some iron pyrites and a little galena, calcite, amethystine quartz and a little fluorite, which is mostly green but sometimes purple. The silver occurs in the ore bunches chiefly as argentite, in nugget, sheet and leaf form, with some native silver. This mine has been worked longer and more extensively than any other mine in that district. It has always been owned by private capitalists, who, owing to its extreme richness, have been loath to place it upon the market. It is consequently rather hard to get reliable information regarding it, but suffice it to say that the vein has been followed with the diamond drill for over a mile, and although it has been extensively worked, it still continues to turn out large quantities of bonanza ore, which is shipped away to the smelters, besides a large quantity of milling ore, for which purpose they have an excellent mill about half a mile from the mine. This winter is the first that they have attempted to work it all the year round, the mine having previously been shut down during the worst of the winter. The monthly shipment from this mine varies from $25,000 to $40,000.

THE BADGER

Is the next of this group of importance. It is situated in the Township of Gillis, in near proximity to the Beaver and Rabbit Mountain. It is an exceedingly rich property, being very rich and full of black nuggets of silver, and has more than twice paid for the money expended by the original shareholders. It was discovered about the same time as the Rabbit Mountain, but it was so capped over with trap that it was only fairly brought to light by Mr. Eishweiler, an American explorer, who in 1886 sunk a shaft in the property which resulted in a good looking vein being found, and which has resulted in the formation of the mine into a stock company. Under vigorous development it soon asserted itself as one of the most wonderful silver ore producing mines on this continent. In 1890, the Porcupine, an adjoining property, was purchased for $50,000, containing the continuation of the vein which is about 3½ feet wide and extends on the property for a distance of about 3,000 feet. The vein consists of argentite, black blende and galena, with large nuggets of black sulphide of silver, calcite, amethystine quartz and a little fluorite, mostly green, but sometimes purple. The vein has been pretty thoroughly explored by means of shafts and adits. The mill puts through about 35 tons daily.

SILVER MOUNTAIN EAST END.

The next in order is the Silver Mountain East End. It was discovered in 1884, but although some $12,000 was spent in trying to develope it under option by some Cleveland capitalists, they failed to discover anything of value. After they had given it up the original owners discovered native silver in large quantities a few feet from where the Cleveland company had left off, resulting in the sale to an English company in 1887, who have since that date been continually working it. They have now discovered no less than 9 veins on the property all bearing silver, and at 800 feet down they have discovered immense bodies of native silver. The main vein is about 4 feet wide and consists of native silver blende, black and brown, a little galena, wlth a gangue of calcite and amethystine quartz, with a little fluorite, mostly green.

WEST END SILVER MOUNTAIN.

West End Silver Mountain is a continuation of the same vein as the East End. The average of the vein is about 6 feet here, the nature and composition of the vein being almost identical with the East End. This property has been sold during the past year, and developments are being pushed rapidly forward. The author may here remark that there are numerous valuable locations and veins in the Silver Mountain and Beaver districts which space will not permit of description in detail, amongst which are notably the New Thunder Bay mine, owned by a company in Minneapolis, the Crown Point and others. But suffice it to say that in this district there is not a single instance of a failure where any development has been done outside of the most superficial character, which speaks much for this but little known district, especially when the history of the mines in the east around Port Arthur has, with the single exception of the Silver Islet Mine, been one continuous record of disaster and failure.

As lead ores are of importance in the smelting of silver, it may be interesting to note that there are several good sized veins in the neighborhood of the Townships of Dorion and McTavish, notably the Ogema, which has been recently bought by Philadelphia capitalists, who propose putting up a smelter on the property next summer. The vein is a very strong one, running parallel with a high granite ridge, and occurs along the line of contact of the granite bluff and the gneiss that forms the valley below. The vein outcrops about half way up the bluff, and is partially covered by fallen rocks and debris. Its strike is a little north of east and south of west. The pay strike is about 14 inches wide at the surface, and nearly solid galena. About 20 feet below the outcropping an adit has been run, cutting the vein at this point two feet in width, and carries richer ore at the surface. The galena is of a very high percentage. Assays from the surface outcropping showed it to carry 24 ounces of silver to the ton.

Before entering into a description of the iron ores of the district, it may be interesting to note the discovery of manganese in paying quantities, an ore which is so much wanted in the production of the higher grades of mild steel. The following is an account of the discovery made during the past summer by the employees of the New Silver Islet Co. At Cape Gargantua they discovered a vein of hydrated black oxide of manganese 7 to 10 feet wide. It rises out of the lake and crosses a large island. The vein rises up like a dyke from 4 to 10 feet above the surrounding country rock. In many places the quartz is weathered out and the manganese ore left standing. The manganese is on both walls of the vein, and a strong seam or band is distributed through the middle of it. The ore assays 45 per cent. metallic manganese. The importance of this discovery can be appreciated, when the quantity of iron already known to exist in this district is taken into consideration. Last but not least in the list of Algoma minerals stand forth the iron ores of the Thunder Bay and Rainy River districts, which bid fair to take the lead of the iron mines of the world whenever facilities are opened up with the United States for the free transportation of iron ores. Amongst these the Attic Okan iron beds are the most remarkable. The first of these locations was surveyed in the summer of 1886 by the author. The property was shortly afterwards examined by Mr.

D. H. Bacon (now superintendent of the Minnesota Iron Co.), and on his report bonded for a long term to a Cleveland party. No active operations having been begun, the discovery of the iron did not attract general notice in any way until the finding in 1889 of another rich deposit, several miles further west on the same range. The result of this was the starting of numerous exploring parties, and the discovery of still other outcrops of the same ore further westward, until now these rich deposits have been traced by outcrops for a length of 30 odd miles along the belt.

Nothing more than a superficial examination of the deposits has been made, in the way of a few surface cross cuts and an occasional shot to secure unweathered samples; but in many places the ore outcrops boldly, showing a varying width of from 10 to 50 feet. These outcrops occur in veins or lenticular beds in the Huronian formation lying between the Huronian trap and chloritic schists, which are nearly vertical, having a dip of 86° north, and a strike of N. 75° east. The surface showings indicate that there are several of these beds, the intervening rock having a width of from 5 to 30 feet. Whether these beds will unite at a depth or maintain their separate identity, is a problem for development work to decide. The Huronian belt has an average width of eight miles, and rest conformably in the folds of the Laurentian rocks, so we may presume its depth (and that of the imbedded magnetite), to be very considerable, practically unlimited. The Graham property is the most easterly on the range, and its most conspicuous outcrops occur on the summit and both faces of a bluffy ridge running nearly east and west 100 feet above the level of the Attic Okan river. Mr. D. H. Bacon sampled the surface showing here, taking samples at three inches intervals, and for an aggregate width of 80 feet these samples gave 63½% metallic iron without more than a trace of phosphorus and little more than a trace of sulphur; no titanium. The outcrops here showed three beds of ore.

Immediately west of the Graham property is Sabawe Lake, a sheet of water three miles in length. For some distance west of the lake, in the course of the iron belt, a considerable depth of soil covers everything; this extends to location R. 400, on which, and R. 401, other outcrops occur very similar to those on the Graham property. A similar ridge traverses these locations, and in many places, especially on the southern exposure, which is very steep, large outcrops occur. The ore throughout this range varies but very slightly in character or grade; it is virtually identical throughout, though in some places, where greatly exposed to atmospheric action, it is of course leaner. On location R. 400, where a natural exposure of ore some twenty feet in width occurs, a large number of samples taken at random gave from 66 to 68½% metallic iron. On the location west of this, R. 401, a surface cross-cut was made this summer, which showed 46 feet in width of ore; the full width was not ascertained, as the cut was abandoned on account of the depth of overlying soil and large boulders. Some of the ore from this cut, when protected by deep soil, gave as high as 71% metallic iron. A little more than half a mile west of this the ore again outcrops on the south face of a ridge about 50 feet in height, the intervening ground being low; samples from here gave 35%. Half a mile further west a short trench dug in the low ground showed rich ore at a depth of only 3 feet. No attempt was made to uncover the width of the deposit, the sole object being to locate it. A mile beyond this, numerous showings are found along the top and south face of a ridge about 100 feet high; the surface showings here are very extensive, and the ore of the same high grade, 66-68%. For nearly 3 miles beyond this the ground in the line of the deposits is very low, and no attempt to locate the ore by test pits, etc., has been made. As the ground rises, the ore again outcrops and shows at the crossing of the Attic Okan River, which is very rapid at this point. About 1½ miles further west lie the Garland locations, on which there is an outcrop of magnetic iron ore, uncovered, from 25 to 28 feet in width across the ore formation and about 400 feet in width. Owing to the small amount of work done, the walls on either side have not been found. This outcrop is about 10 feet above high water mark, and on the bank of Attic Okan River.

Assays from this ore body, made by the Sharon Iron Works, Pennsylvania, gave the following results:—

Metallic iron	68·76
Silica	1·41
Phosphate	0·006
Sulphur	0·185

Mr. Hill, assayer, Port Arthur, gave a result of test of same ore of 67·75 metallic iron. Mr. Rossman gave 70·8 metallic iron. The formation of the iron range is invariably almost vertical. On lots 111 E. and 118 E. there is a very large ore body of magnetite. This outcrop or bluff, which is situated about half a mile north of Attic Okan River, rises to a height of from 125 feet to 175 feet, and is in most parts covered with vegetation. A trench about 6 feet wide, extending from the top and across the ore formation 135 feet, and measured from the top to the base gave 210 feet at an angle of 45°. The length by survey is almost half a mile. The ore body presents the same characteristics as 109 and 110 E. and results from an assay made by Prof. Hays, of Toronto, gave 68.67 metallic iron. The surrounding country is well timbered with tamarac, spruce, pine and birch.

These four 80 acre locations extend along the range for one and a half miles. Exploratory work has only been done in two places, but the ore body is plainly visible in many places on each of the locations.

The author has also surveyed three more locations for Mr. Garland, in which the ore changes, over part of it, to hematite, but still of the same high quality; and to give a faint idea of the value and extreme purity of these ores, annexed is a short report by Mr. J. C. Thomas, an American expert, together with copies of assays over different parts of the belt; and it may here be remarked that they show conclusively, by the entire absence of titanium and the low percentage of sulphur, phosphorus, and silica, that they are essentially high grade Bessemer ores.

Detroit Iron Mining Company,

Mr. Lee Burt, Manager,
Detroit, Mich.

Dear Sir,—On my return from Port Arthur I give you a report of my examination of the iron property in the Rainy River district, on the Attic Okan River, known as the Garland property. I was very much surprised to find such fine outcroppings of iron ore. It was beyond all expectations. The iron range, running about east and west outcrops at an elevation of 125 to 175 feet, and 1,000 to 1,500 feet in length, showing very fine quality of ore, such as you will see by the samples. Sample No. 1 was taken from about half way up and partly across the top of the bluff, a distance of about 135 feet on the ore formation. Sample No. 2 was taken from 10 feet above the surface of the river, a distance of 25 feet across the ore formation. The exact width of the ore can't be given, as there is not enough work done to uncover the ledge. If in case these samples should not go as high in iron as may be expected, I don't think it ought to be any set back to the property, as better results would be reached in opening up the ore body. These samples were taken from the surface of the ledge. The results of the samples you will please add to this report. If the property should open up as well as I expect it will, and I have every reason to think it will, the ore can be mined and put into the cars for 35 to 50 cents per ton at a large output. No definite estimate can be given as to the size of the ore body or to the amount of ore that can be produced until more work is accomplished.

Yours respectfully,
J. C. Thomas.

Ishpening, Mich., Aug. 25th, 1890.

Assays of Attic Okan Magnetite—Graham Locations.

	Averages by Mr. D. H. Bacon.			Chapman.
	(1)	(2)	(3)	
Silica	6·60	7·30	5·89	2·43
Alumina	1·09	1·80	·98	0·67
Ferrous ox	....	....	....	23·32
Ferric ox	87·66	86·90	88·36	46·74
Manganesic	trace	trace	trace	....
Calcic	1·28	0·90	1·40	....
Magnesia	0·75	0·60	0·75	....
Phosph. acid	0.079	0·069	0·025	....
Titanic acid	none	none	none	none
Total	94·46	97·57	97·41	
Metallic iron	63·47	62·84	63·97	70·06

The first three are averages from the three beds sampled by Mr. Bacon, and the last is a single specimen given Prof. Chapman of Toronto.

Locations R. 400 and 401.

	Assayed by Minnesota Iron Co.	F. Hill, P. Arthur.	H. M. Currie for Carnegie Bros.
Metallic iron	68·50	65·90	65·701
Silica	2·90	5·80	4·20
Phosphorus	0·015	0·001	0·003
Sulphur	0·052	0·16	not specified
Titanic acid	none	none	none

Assays by Sharon Iron Works, Pa., of samples furnished by Capt. M. N. Garland, as from property marked "Garland Locations":

Metallic iron	68·75
Silica	1·41
Phosphorus	0·006
Sulphur	0·185

Assays of Attic Okan ore by Geological Survey of Canada. —Dr. Hoffman, Assayer.

1. Magnetite from R, 402:	
Metallic iron	68·579
Titanium	none
2. Magnetite, R, 400:	
Metallic iron	68·027
Titanium	none
3. Magnetite from R, 403:	
Metallic iron	64·551
Titanium	none
4. Magnetite from line between mining locations 10 E. and 11 E., collected by Smith:	
Metallic iron	65·710
Titanium	none

There is also a very fine deposit, or rather vein, about 30 feet wide which occurs on the line of the Port Arthur, Duluth and Rainy River R.R., and contains magnetite carrying 56 per cent. from average assays of the surface. Nor are these the only deposits of Bessemer iron ores to be found in this district, there being heavy deposits on Hunter's Island on Gun Flint Lake, and near Kaministiquia Station, which are all reported as being valuable. Railroad communication is of course absolutely necessary for almost any kind of mining, so as to afford the means of cheap transit, but this is particularly so with regard to iron ore. For this purpose the Port Arthur, Duluth and Western R. R. is being constructed from the shores of Lake Superior, at Port Arthur, to the American boundary at Gun Flint Lake, and branching from this road the Ontario and Rainy River R.R. is being surveyed to communicate with the gold fields in the Township of Moss and the iron fields on the Attic Okan River. With regard to the market for these ores, and the cost of delivering them thereat: Mining will cost from 75 cents to $1 per ton, say $1 as an outside estimate; railroad freight to Port Arthur or Fort William, $1 per ton; lake freight to either of the principal ore ports on Lake Erie, Cleveland or Ashtabula, may be taken as the same as that from Ashland or Two Harbors, the shipping ports of the Gogebic and Vermillion districts. The rate last year and during the past season has been about $1.25 per gross ton, and there is no reason to think this will be exceeded in the future, considering the continual increase in number and tonnage of vessels built on the lakes. Shipping charges, insurance, etc., may be taken at 30 cents per ton; duty going into the United States 75 cents per ton. This will give the total cost delivered at a Lake Erie port of $4.30 per ton. The present value of a high grade Bessemer ore, such as this under consideration, delivered on the docks at Cleveland or Ashtabula, is $6 per ton, which would leave a net profit of $1.70 per ton. So that even with the American high tariff of 75 cents per ton, there is no reason why these ores, and particularly from the Attic Okan range should not be mined at a profit.

In conclusion the author thinks it is safe to predict that before the lapse of many years, West Algoma will take a prominent place amongst the ore producing districts of the world. So far the diversities of ores that have been found are so great, that there can be but little doubt that when the country is more carefully explored by practical prospectors, many ores that have hitherto been unsuspected, will be found; and with development numbers of rich mines will be discovered. Canada as an ore producing country has in the past been sadly neglected, and although our neighbors south of an almost imaginary line have been developing and bringing to the fore the mineral wealth of that great country, we with far richer mineral wealth have so far hardly touched our resources. This, we might almost say, fatal national apathy can hardly last much longer, indeed it is in a measure fast disappearing, and when it does disappear, the author is confident that West Algoma will produce almost untold wealth. In dealing with so large and extensive a subject the author has found it necessary to condense considerably the information he has obtained regarding the mines, for to describe some of them properly would afford a fit subject for a paper alone, but the author will always be happy to afford any information in his power to anyone seeking information on this very interesting subject.

PORT ARTHUR SILVER SHIPMENTS.

Silver shipments from Port Arthur District, Jan. 1st, 1890 to Jan. 1st, 1891, to the U. S. A. as per U. S. Consular agency reports:—

Beaver Mining and Milling Co	$ 80,000
Badger Silver Mining Co	95,500
West End Mining Co.	2,750
	$178,250

N.B.—East End Silver Mountain Co. ship all their ore direct to England. The amount shipped is not known, but it is safe to estimate it at not less than $50,000.

Titles to Mining Property in Nova Scotia.*

By B. C. Wilson, Waverley, N.S.

One of the most important considerations in connection with the mining industry in Nova Scotia is the validity and permanence of the titles; and this applies to both the land or surface privileges and the mineral right, which by our laws are held separate and distinct.

The days of individual effort in mining, and the investing of labor only instead of capital have passed, or at least are rapidly passing away, and the absorption of the smaller holdings by capitalists and associated companies into larger properties is taking its place, and the investing of large amounts in initial outlay for plant and development, which increased depth of workings and consequent larger operations render necessary, brings the value of the titles very prominently to the front.

According to our laws, the minerals, with few exceptions, are vested in the Crown, and the land or a major part of it, having passed out of the Crown, and being held by individuals in fee simple, it is evident that the claims of the miner and the land owner must frequently clash.

When gold was discovered in the Province and licenses to work were issued by the Government, this difficulty was recognized and met by the Government buying up the grounds in the proclaimed gold districts, or "revesting," as it was termed, and the Government recouped itself by charging applicants for mining leases the relative amounts paid per acre for these grounds, in addition to the $2 per area mineral charge, thus granting a mining lease with a soil right for twenty-one years.

This, though it involved an initial outlay of from $8 to $10 per area, was eminently satisfactory to the miner, as the validity of his title was assured.

This method was pursued at Tangier, Sherbrooke,

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*Read at the regular meeting of the Gold Miners' Association of Nova Scotia, October, 1890.

Waverley, Ovens, and other places ; but later on the revesting method was deemed injudicious, and the law of "arbitration" between the several lessees of mining lots and the owner of the land, was substituted.

This system still prevails, and while its advocates claim it works comparatively well it is undeniable that in many instances it is alike unsatisfactory to the miner and land-owner, and has resulted in much friction and litigation, and as the principle of that law and its results develope and become more generally known, that friction and litigation will increase.

So long as the mining locations are confined to uncultivated or "wild land" the solution is comparatively mutual and easy, but when they encroach upon cultivated grounds or, as in some cases into the gardens and even dwellings of the *bona fides* land owner, very naturally the spirit of resistance is aroused, and whether legally, judiciously or otherwise, instances are not wanting of great acrimony and almost armed persistence in opposing the presence of the miner, and the constitutionality of our Statutes may yet have to be referred to the Privy Council of England for adjudication as to whether a person can be ousted from his legally acquired estate and be obliged to take such remuneration as a committee of arbitration may award him, particularly as the individual may be an unwilling partner—or even refuse to be a partner at all in such arbitration.

The State reserves to itself the right to acquire any lands required for national or public welfare—as for instance for defence or public buildings, for highways and railways, but in this case our Statute provides for an arbitrary use and occupancy of one man's property for another man's convenience or profit.

Recently our Local Government have seemed to take the ground that in granting a mining license, they are simply giving a quit-claim deed to a prospective but undefined property, something on the principle they sometimes dispose of cattle on the western prairies—"sell them running, and let the purchaser catch them if he can." But the result of such an irresponsible course cannot but result disastrously alike to the individual and the Province. Let it once be known abroad that a Government title to a gold mine is only a purchased law suit, and how much foreign capital will find its way to the Nova Scotia mines? In short, it is an untenable position which the Government cannot afford to hide behind, and it is only a question of time, perhaps, when our legislature may have to face the question of how far they are responsible for having granted a mining lease to a person who has not brought evidence of having made his peace with the owner of the land, and having taken his money and granted such lease, how far they are committed to put him in possession of his property instead of leaving him to fight out a tedious and expensive law suit—of which there are instances at present existing.

In the matter of the grounds before referred to, which were bought up by, or revested in the Government (and on which the applicants paid for the ground as well as for the mining privilege), it is pertinent to remark that when these leases lapsed by expiration of term they were renewed at $2.00 per area for mining lease, nothing being said about the ground, the inference being that the title being in the Government, the soil conditions would remain as formerly, that is reserved exclusively to the use of the holder of the mining lease ; in fact to my personal knowledge the mines officials gave this verbal assurance in certain cases.

In the year 1885, however, an act of the Local Legislature (somewhat ambiguously expressed) enacts that "All such revested lands shall be considered and dealt with as Crown Lands," which practically puts these grounds in the market at forty cents an acre to the first applicant, and being so granted it follows that the miner is at the mercy of the land owner and has no right there which such owner need respect, and individuals would not long be wanting who would take up such revested lands on speculation, and already applications with that view have been filed.

To the unprejudiced mind this would appear like arbitrary confiscation of the miner's rights, Protests and objections to such grants have been filed and it remains to be seen what action the Government will take, or whether they will consider the immediate acquisition of the 40 cents per acre paramount to what must necessarily result in curtailed receipts from rents and royalties—not to mention the resultant friction, litigation, delay, and all uncharitableness inflicted upon the individual sufficiently enterprising to invest in mining properties.

I understand however it is the expressed determination of the Government in regard to these "reverted" lands —*not to grant the surface to any one without the consent of the mining lessee.*

This is as it should be, and if it so remains, well and good, but to settle the matter so it may not raise its unwelcome presence again, a recorded order-in-Council putting it beyond resurrection should be urged upon the Government while they are in the humor.

Since the introduction of the "Arbitration" law in regard to land titles, the matter has become considerably mixed. This law requires the mining lessee to make such terms with the land holder as best he can,—failing in which, *arbitrary* arbitration settles the remuneration, and each individual lessee has to independently settle for his respective areas.

In some instances arrangements were made by consideration for damages,—or by lease sometimes with, and sometimes without writings, in other cases by absolute deed, and still in other cases by no arrangement at all ; the parties taking out mining leases of ground on which they never entered, consequently had no immediate need to make terms, and in course of time either transferred or forfeited, and new owners stepped in, until it would perhaps puzzle the original land owner as much as the present mine owner to know in whom the title rests, or how much of the land is vested in the *should-be* owners.

The danger of this state of affairs lies in the possibility and evident probability of parties quietly acquiring these scattered titles, and letting them lie dormant till some development brings the value of the property prominently to the front, when these claimants will spring into active and aggressive life.

I have thus far confined myself to the land titles, but may be allowed a remark in reference to the mineral right.

It is laid down on broad principles that the minerals in Nova Scotia are reserved to the Crown. It should have been added however "with certain exceptions," for it crops out that certain *land* grants made to certain individuals at divers times and places, also conveyed the *minerals* as well, and that large portions of some counties and whole townships are independent of the Crown as regards the mineral rights. For instance, the Township of Truro is said to be so exempt, and there are claimants for the mineral rights at Oldham and Montague, where I believe a decision has not been reached yet ; and probably there are many other places in the already worked gold districts where such claims may be, or are set-up ; and minerals are now being discovered all over the Province, and in places where mineral rights were considered of no value because none were supposed to exist, and the outcome of it may be that a discoverer may obtain a title or lease from the Government, in good faith, of property over which it is presumed to have control, and may erect expensive works thereon and invest large capital and develop a valuable property, only to be confronted by a claimant with a better title, and be invited to vacate forthwith.

I am not prepared to speak definitely on this point, but am informed that a case of this kind is now interesting the investors, if not the Government, At least it would appear that such a case is quite probable, and if so might form another case where the Government may have to consider its responsibility.

I think it unnecessary for me to enlarge upon the unfortunate results liable to follow this condition of affairs. Our own people who are, or may think they are, conversant with the ins and outs of the situation may not place as much value on the matter of titles as its importance demands, for, whether from want of means or lack of enterprise, the fact remains that our people invest but sparingly in mines, not in gold alone, but in coal, iron and other minerals. In short the bulk of our mining capital comes from abroad, and capital is proverbially cautious, and the perfect title is what the foreign capitalists first look for as the main protection of a non-resident, and it is alike the interest of the Government and the individual to encourage the industry by all legitimate means.

I may just here be allowed to refer to one other feature connected with the business.

It does seem invidious that this one industry should be singled out for special handicapping.

The agriculturist or the lumberman can get a grant and unquestionable title of a hundred acres of land for forty dollars, and proceed to extract as much product as he can, not only without any special tax added, but in some instances gets an actual bonus by way of encouragement, while the miner is charged about $240 per hundred acres for a *lease title of twenty years'* duration, handicapped with a land claim for an unknown amount, and instead of any bonus or encouragement, is mulcted two per cent. on all the gold he extracts or so much per ton on his iron or coal, and gets in return a litigant privilege to fight all comers.

Naturally the miner feels, when paying out so much money he should get some consideration beyond the patriotic privilege of contributing to his country's exchequer ; and if this took the form of unquestionable title it would largely soothe the aversion one reasonably feels in paying out money for which he recognises no adequate value or return, but when on the contrary it merely introduces him to unknown annoyance and expense, it simply becomes exasperating, and if applied to any other industry would cause a revolt.

I do not wish to be understood as casting reflections on our Government or even inferring neglect. Speaking personally, I can bear testimony of having invariably found the Executive and the officials affable and ready to deal liberally and equitably within the limits of their jurisdiction, but unfortunately they are not infallible like his Holiness, and with very best intentions for both public and private interests, are liable to oversights and mistakes, and they are hedged by certain Legislative enactments and inherited conditions which makes their position a kind of buffer between conflicting interests, and not a very agreeable position either ; wherefore it is desirable and judicious that every individual interested in the success of our mines should use his individual and united intelligence and efforts to suggest and influence equitable legislation for the protection and encouragement of the mining industry, and no one should object to this, for does not the whole community benefit through the mines?

The agriculturist, the lumberman, the manufacturer and the laborer all find customers and not competitors in the mining industry. This is an age of combination, and there is no injustice in miners combining for mutual protection and encouragement, and it is regretable that so little interest is evinced by mining men for their *united* interests. They all acknowledge the desirability of effort and improvement, but fail to exert their influence unitedly. The bundle of sticks lacks the encircling cord of union.

One would almost infer that the main object with all, is rather to bear the ills they have with a true miner's hope by some lucky strike soon to be able to retire, bid goodbye to the business and let the devil take the hindmost.

Another question might also merit the attention of the Government and ourselves as well, being one which will eventually demand adjustment, whether any great financial benefits result from it or not. It is, the ownership of the crushed ores or sands after they have left the mill ; for claims have been set by mine lessees that ores of former miners brought from other localities and deposited on these areas previous to the present lessee's occupancy, come under the mining act of minerals and *belong to the* PRESENT *lessee*. The case may be stated briefly. Does the crushing and treating of the ore, for the free, or amalgamatable gold, constitute all the claim the miner has to the quartz his labor or money extracted from the earth? Does the depositing or storing of these sands on another person's property, whether held by mining lease or deed, constitute a trespass, or forfeit the ownership? and if the latter, to whom revert?—to the owner of the soil? to the Government? or the mining lessee? And what about the commercial value of these sands for industrial purposes? for it is a fact they do possess *now* a commercial value which may be increased in the near future.

While it may be conceded that the Government have a claim on those sands for royalty on all gold eventually extracted from them, in consequence of their original habitat or origin, it certainly does not follow that they come under the original intent and meaning of the "Grant" or "Reservation of Minerals" contained in such ground—that is, so far as to again hand them over to another person. The Government has once received its *quid pro quo* for this ore, and has placed no restrictions of how, when, or where it shall be treated.

I take the ground, that ore once legitimately mined is the property of the person whose labor or money produced it, no matter how treated or where deposited, and remains his, both for mineral and commercial purposes, until alienated by sale or abandonment.

What may constitute *abandonment* may require a statutory definition ; as to how long a virtual neglect of such sands on lands *not owned* by *the depositor* shall constitute a forfeiture, and then to whom they would revert ; also to define what penalty shall attach, if any, for trespass for depositing them on *any* ground ; and if on Government soil if any penalty at all shall follow, unless it may be the recouping to the mining lessee for any actual inconvenience suffered by any such deposit post-dating his lease.

There are cases where abandonment may be inferential—as, for instance, A. may take a quantity of ore to B.'s mill for treatment, and the sands are run out to the common receptacle ; clearly A. abandons further claim. Again, B. may deliver his sands directly from his mill into a brook or river, where no accumulation takes place, and they are carried by the current to indefinite distances. The inference is that B. abandons them.

There are also instances in the Province where parties, anticipating results in the future from these sands, after the oxidizing influence of the elements had liberated the gold in the sulphurets, did at the inception of their works purchase ground (irrespective of mineral right) whereon to deposit or store their crushed ores, and where they still remain ; the soil title still intact, and the sands never abandoned.

In such cases there can be no question of ownership, and aside from these, I fail to comprehend how the depositing of any *ores* (crushed or otherwise) by A. on B.'s ground gives B. any title or claim to them any more than would the placing of so much *cordwood* or *hay* thereon give B. a title to them. Nor can I understand how the Government can claim such sands—that is, give another mining lessee power over them—unless by some process of abandonment, or law yet to be enacted, they legally revert to the Crown. Nevertheless it is well that these points be definitely settled before investments become involved and litigation follows.

I may further call your attention to another custom in the Mines Office, which to the ordinary layman seems like something which "no fellow can find out." I refer to the apparently unnecessary number of dates used on a mining lease, and to illustrate, quote the exact figures from an existing lease—

We read first, "This Indenture made this 2nd day of October, 1888 ;" and further on, "To have and to hold for 21 years from 28th August, 1888 ;" and on the back of the lease appears, "Registered 12th October, 1888."

Now here are three dates employed in conveying a property for twenty-one years. The most prominent one is the 12th October, 1888, but almost any one can understand that date of document and date of registry rarely correspond ; but when lawyers get confused, as I know of an instance during the past week, it is not unreasonable that less educated persons should err. The main trouble lies in the two first dates, and there are no valid reasons why the date of Indenture should not correspond with the date of Application, as that was the time the engagement was entered into ; and if the Government for their own convenience deferred making out the lease on that day, it was no fault of the lessee.

I am informed a law suit is now pending through this very misleading array of dates. It is a simple matter to so remedy it that none need err.

Another feature in the regulations at the Mines Office I may call your attention to, that is in the matter of the transfers and division of leases ; for instance : A. owns a certain mining property held under mining lease in regular form. In the course of events he sells to B, and legally and correctly transfers the same in accordance with the regulations at the office, and hands over the lease to B. This is the present mode of transfer, and is presumed to be legal and sufficient. B. takes his transfer and lease to the office, and on the record book an entry is made, "Transferred to B. this 5th day of September, 1890," and the original lease is handed back to B. That is all there is about it. B. looks at the lease and finds it is a lease to A., is in A.'s name, and not so much as an endorsement of transfer or anything to show that B. is the now owner of the property designated by such lease.

Now this may be all right and valid enough. But does B. consider it so? And presuming B. is acting for a syndicate or company, what will his associates say to him when he presents a lease showing that A. (not B.) is the recognized owner of the property? To satisfy themselves they would each have to make a trip, perhaps from England or the United States to Halifax and pay 25 cents merely to read thus: "Transferred to B. this 5th day of September, 1890;" and even then does it not carry with it a feeling of insecurity? The only way to remedy it is to surrender and take out a new lease paying $2.00 per area therefor, merely to get the lease into B.'s name. Such a method of extracting money, if practiced by individuals, would be termed dishonest.

And still another case: presuming A. has a lease of 100 areas in one block and sells 50 of them to B., A. makes out a transfer of 50 areas to B, which is duly presented at the Mines Office and recorded as before, and there appears on the records: "Transferred 50 areas (numbered so-and-so) to B, this 5th day of September, 1890." That is all there is to that. B. gets nothing more from the office to show his ownership; he does not get the lease from A.; he does not get even an endorsement placed on A.'s lease to show that half of it belongs to B, but A. still holds the lease, to all appearance unencumbered, of the whole 100 areas, and B. cannot even surrender his 50 areas and get a new lease in his own name, even though willing to pay $100 for it. But A. must do the surrendering, and then it appears that A. cannot surrender 50 areas for B., but he must surrender the whole 100 areas, and this involves another $100 to enable A. to get a renewed title to what he may have only a month before paid his money for, and now have to pay it over again.

Such a procedure among individuals would be designated by the slang term of "snap game," but we are loyally bound to presume that our government, like Cæsar's wife, is entirely above suspicion; nevertheless, they take the money all the same, and the miner discovers that it is pay! pay!! pay!!! eternally, and yet the miner, while asserting that something should be done, does not individually or collectively make much effort to see that that desirable something *is* done.

Now, in reviewing the foregoing I may be reminded that this is taking a pessimistic view of the matter; in other words, "more frightened than hurt." Admitted that it is so, it is indisputable that the fears expressed, if not realities now, are liable to be so, and most assuredly will be as the mining interests develop and properties increase in value, and it does seem as if the public generally look upon the miner—or at least the mining interests—as fair game to be plucked whenever the opportunity offers, and while, as I before remarked, those who administer the government are, I believe, desirous of fostering the industry, yet it is apparent that a great system of oppression and annoyance has grown up with the administration of the Mines Department, for which no one department of the government or any individual is directly responsible, unless it be the miners themselves, who by not offering suggestions to our legislators, or by not timely protesting against repressive or onerous legislation (or *custom* which has grown into power through use and precedent without legislation), have practically sanctioned the existing system. Our commissioners and mines officials cannot reasonably be held responsible for these idiosyncrasies of law and office custom, they necessarily are men quite inexperienced in mining matters and requirements, who have been called upon to inaugurate a new department. Statutes on one side have directed their course of action and their office regulations—(for I consider that many of the regulations enforced there have no legal status beyond what they have acquired through continued observance and no one questioning their validity)—are simply the outcome of the necessity for some method and order, which were from time to time adopted to meet the exigencies of the case, while the parties most interested—the miners—not only did not suggest any matured method, but did not vigorously protest when the practice or law was inimical to their interests, and instead of uniting for mutual benefit and redress, merely contented themselves with some individual grumblings.

The new law of yearly rental of 50 cents an area in lieu of working provides that the lessees shall pay 50 cents per year per area, otherwise the lease is forfeit on expiration of a year and a day. Now presuming A, B, C and D apply for 40 areas and get a lease in joint and equal ownership, and at end of the year C and D decline to renew, that is, pay their proportion of the $20.00 yearly rental. A and B desire to continue and are willing to pay. Now in such case how much, if any, of these 40 areas are liable to forfeiture, and if half of them, which half? And can A and B retain their half and the others be forfeited, or will the whole have to be forfeited and A and B take up what they choose, with the risk of some one stepping in ahead of them, or what course is open to them? Of course A and B can pay the whole amount; but this continues C and D as equal owners *without paying anything*. Of course the government may say "this is a matter of partnership over which we have not control and are not interested." Very true! But the action of the government has yoked them together but has provided no means of divorce. It is going to produce friction and litigation, and certainly it is the duty of the government to so legislate as to reduce rather than foster litigation. For if this thing goes on the result is not far to see, the whole province will become one vast law court, and the revenue from royalties will practically cease.

B. C. WILSON.

SOME MEMOS. OF TITLES IN CERTAIN LOCALITIES.

RENFREW.—The government bought up the land at $4.00 per acre and leased to mining applicant at $10.00 per area, including the $2.00 for mining right, thus making a gentle profit of about $5.00 per acre. In or about 1868 the system ceased, and the government charged $2.00 for a mining lease and left the lessee to settle as best he could with the land holder. But all that the government paid for it holds yet, and of course comes under the Crown Land clause of the Act of 1885.

The Ovens—LUNENBURG.—There was much difficulty here in arranging the land rights, but believe it was settled by the government giving "Misener" so much for the damage done, and allowing him to retain use of his farm subject to all the annoyance the miners see fit to visit on him.

MONTAGUE.—The land was bought by the Government and leased to miners same as Waverley and Renfrew, but a claim to the minerals and land has been set up by the Canal Co., to certain portions, and is still under consideration.

SHERBROOKE.—The land was purchased by the Government or revested but I do not know at what price paid, or charged to the miners.

After the "Arbitration" law came into force, the Government ceased to buy any more land, and any allotment of new areas since come under the Arbitrations scheme.

TANGIER—The land was bought by the Government, but I have not learned how it stands now.

WAVERLEY.—The land was bought by Government at $8.00 per acre and leased to mining applicants at $2.00 per area mining right, and $8.00 per area land right, total $10.00 per area. The Government title was found to be defective, and a large number of areas are now covered by freehold right which the mining lessee has to respect. The rest still remain in the Government, their title to these having been perfected.

OLDHAM comes under the same category as Montague, a kind of triangular contention between Government, Canal Company and the miner. I do not know how it rests, who is uppermost, or whether the miner is on top or between the upper and nether millstone.

SALMON RIVER, having passed through all the trials that opposing limbs of the law could think of, is presumed to have a good title.

UNIACKE.—The titles are considerably mixed. Some of the ground the Government bought and leased with the mining lease at from $4 to $6 per area, and some the lessees arranged for, and for some no arrangement was made. Any mine not much good is presumed to have a defective title quietly slumbering, waiting for the gold to grow.

B. C. WILSON.

On motion, it was voted to refer the above paper to the Committee on Law and Legislation, with instructions to embody in a report some suggestions looking to the remedy of the evils described.

Report of the Committee on Law and Legislation.

(Regular meeting of November, 1890.)

Mining titles in Nova Scotia naturally arrange themselves into classes, owing to differences in mode of derivation, and the variety of treatment that has been accorded to them in different cases.

In the early history of this Province, certain grants were made to favored individuals, where not only the land itself, but also the minerals underlying it, were passed by the Crown in fee under the grant, and as these titles sometimes arise to confound the miner who has paid his money into the office of the Department of Mines, it seems to be the obvious function of the Government to have schedules or tabulated statements prepared, fully informing the public of the particulars of such grants, their location and boundaries, so that no mistakes or losses may arise to innocent persons who may have paid their money in good faith.

Another class of title arose where the lessee of gold mining rights also enjoyed surface rights, under his lease, which conjunction took place where the Crown had revested the land on the discovery of gold, or still held it ungranted, and passed it to the lessee in and by his mining lease.

In all such cases where the Crown has either the possession or reversion of both surface and mining rights it is most desirable that they never should be severed, and to that end the Order-in-Council spoken of by Mr. Wilson in his admirable paper should be passed; or better still perhaps an amendment to the Mining Law should be passed and placed upon the Statute Book.

It would also be a desirable thing if when gold is discovered on ungranted lands they should be reserved for mining purposes within the limits of the new district and be passed under the leases passing mining areas; and we might go further and ask that in all future grants of lands now remaining public property, clauses should be inserted for revesting lands whereon gold may be discovered hereafter under appropriate conditions.

In considering the commonest status of gold mining rights in the Province, we find the miners, as a rule, holding leases of gold areas over land that may belong to anybody. There are no surface rights by virtue of the great majority of these leases. The miner must secure them for himself from the grantee of the land or his representative often at great sacrifice, and always under the penalty of forfeiting his lease if he enters and works without having done so.

The question involves three parties, viz.: The Crown or the Department of Mines, the Grantee of the land or his Representative, and the Lessee of the gold mining areas or his Assignees. The Crown grants the land in fee, reserving the gold and all things necessary to its recovery by mining. It also demises the mining areas subject to the surface rights of the grantee or his representatives. The land holder is subject to the incidents of the mining reservation and the miner is encumbered by his liability to pay damages to the land holder.

But some very material points to the disadvantage of the miner present themselves by comparison of their relative positions. The land owner has received a grant in perpetuity of his land, and no dereliction of duty on his part towards the miner will defeat his title; but if the miner enters on the lands and begins to work his mine without having arranged and settled the damages, his lease is forfeited and his title (defeasable at best) is entirely gone. In point of permanence of title then the land owner holds the coign of vantage. He also is better off as regards his product, for no matter how great the value of his crop, or of his timber or other product, he pays nothing more for it to the Government forever, while the miner has to be taxed by a royalty on every ounce of gold he produces so long as his lease runs, and pay annually commutation called rentals, if his areas are not worked.

One would naturally argue that where the Crown gives such manifest advantages to the land holder over the miner, it had received more money—a greater consideration from him as the price of his grant, but such is not the case, for it has received but 40 cents per acre for an undefeasible title to the soil in perpetuity, while from the miner it has received $2 per area, which is a smaller tract, and (if he cannot work his mine), fifty cents per area for each year's occupation, not to speak of royalties. There is surely great inequality here.

Of the three parties the Crown has decidedly the best of it, and considering the larger amount of money the miner pays, it does seem as though it should ensure to him a larger measure of protection and greater help in fighting his battles; but we do not think it has done so in the past, for in addition to discriminating against him in the matter of money payments, he is ever and anon on the brink of forfeiture. If he does not work he is liable to forfeiture, and if he works without having settled damages he is alike liable. It seems to be a case where the Government, which is so great a gainer, ought to bear the responsibility of securing to the miner his dear bought rights, by undertaking to settle land damages, instead of leaving them to be settled by its lessee. There can be very little doubt but that they could be settled more certainly and reasonably by the action of the Government, and with less litigation, and it is the duty of the law giver to prevent lawsuits and not to encourage any system that fosters them, which that now in force certainly seems to do.

It may be worth discussing whether the appointment of a government arbitrator would not solve the difficulty. It would appertain to this official to assess damages in every case, and in doing so he would hardly trench upon any ground where the Government has an interest. We conceive it has a duty to perform in this matter, having taken the money of both parties, as much from the grantee of the land as if there was no mine in the land, and as much from the miner as if it had not already been paid for the surface, full price in both cases; but whatever interest it might have in the reversion of a lease, or a grant, would hardly be affected by any question of damages between the two contestants, always assuming the statutable mode of arbitration to be legal and constitutional.

Any form or class of lease is subject to forfeiture, and insomuch as forfeiture affects title, it is suggested that instead of forfeiture, some other penalty, perhaps money damages, be inserted in the Act by way of amendment, or that any case of forfeiture may be commuted or condoned, by payment of money within a reasonable time. We need not draw upon our imagination for examples of the dangers to titles lurking in the clauses which make forfeiture the penalty for entering and working without settling damages.

There is another aspect to this question of titles that is of unspeakable importance to the gold miner. It is the conversion of our lease-hold titles into fees, so that instead of our present insecurity, we may have, under proper conditions, titles that shall be, when once fully acquired, permanent, perpetual, undefeasible and unforfeitable.

To our mind this is the most vital question we can touch. Its consummation would do more to bring prosperity to our mines by causing the reopening of old mines, the investment of fresh capital, and the prospection of new districts, than any other legislation that could be devised. It would give our mines the same encouragement as is given in other countries, and place our titles on an even footing with theirs. Other things being equal, the money of investors will be placed in a country where it will secure a good and permanent title as against one where the whole investment is liable to be lost by the title being defeated. The risks of mining are great enough underground and miners ought not to be compelled to take additional risks through bad titles. As a matter of abstract justice, the miner has as good a right to be made secure and undisturbed in his possessions underground as the farmer has to the land he tills in the sunlight overhead.

As before shown, once a grant of land is made no further payments are demanded, but on the other hand the miner must keep on paying his royalties to the end of time, with no diminution as he progresses towards the centre of the earth. Why a tax like this should be kept and put on an industry so precious and so costly to prosecute, especially costly when deep ground is reached, is one of those inscrutable things "no fellow can find out," and we do not believe this system of royalties on gold can be defended on any sound economic grounds in a new country like this, whose natural resources stand so much in need of capital from without and where no reciprocal benefits or countervailing advantages by way of rewards or bounties are ever given or offered to the miner.

Large payments of royalties were made formerly in the palmy days of their prosperity by the Goldenville mines. Afterwards they were all shut down on reaching, for this Province, great depths. We might have expected the Government to offer assistance from royalty moneys to the miner who would undertake to incur the cost of powerful and expensive machinery for deep work, but no such assistance has ever been forthcoming, and those mines are still shut down. The Dufferin mine has paid large sums of money in for royalties—probably not less than $12,000 to $14,000 since the mine was started. For all this money the proprietors have not one solitary material thing to show, nor is there any guarantee, nor even hope, that if their quartz should be exhausted to-morrow Government would advance a single dollar to help render their vast and valuable plant again productive.

We contend that such a condition of things is wrong, and in every sense unsuited to the spirit of modern methods.

Run down the whole gamut of our established industries and you find that the tendency of the times is to give bounties, subsidies and bonuses, in short to deal liberally with capital in order to attract it to development of resources, expansion of industries and support of the population.

Railways and steamships are subsidised by Government. The factory is bonused by Municipalities. Certain industries, discriminated against by Foreign Governments are encouraged by Government bounties at home. But our Government so far from giving bounties, taxes its own miners by a perpetual tax. Only mining is taxed and that by a direct tax on production not capable of being distributed infinitessimally over the great consuming public, as are customs and excise duties, but the tax is imposed so that it must remain fixedly, helplessly and relentlessly where it is placed, and be borne alone by that class that is singled out for the distinguished but invidious privilege of carrying it, and is a strong example, almost the only one, of a thing that will stay where it is put.

As an association of miners, jealous and eager for the standing and permanence of our favorite pursuit, we protest against the continuance of leases and royalties.

We suggest that the mode followed in the Canadian North-West be adopted in its general lines by the Legislature of this Province. The proposed changes would, after the lapse of a certain time spent in development, work being done virtually under license, periodically renewed for a time, not exceeding say five years, fees being paid at each renewal, and the expenditure of a fixed annual sum in developing, permit the holder of the claim to buy the reserved gold mining rights absolutely for a reasonable sum.

In the Canadian North-West, lands containing gold are located at $5 per block of 40 acres. This fee is paid annually in advance each year for five years, if so long desired, but at any time before the expiration of the five years the claim may be bought on proof that $500 has been expended on it.

If not bought earlier, the occupant may each year for five years renew his location receipt, paying $5 therefor, at the same time proving that $100 had been expended on his claim during the year. When he elects to buy he pays $5 per acre, and then gets a title in fee to both land and gold.

Upon this framework, with such modifications as our different circumstances might dictate and demand, we may be able to mould acceptable changes in our laws.

Under our present system mines will no doubt continue to be opened, but very few, if any, will be worked to great depths; they will not gain value by development, and abandoned mines will become the rule rather than the exception, until a more liberal policy shall be inaugurated. And we believe that the needs of the miners require only to be presented to the consideration of the Government to secure every concession we can reasonably ask for.

The matters we have referred to may be taken to have escaped the notice of the Government, who would naturally suppose that any inconveniences in the laws bearing hardly on the miners would be brought to their notice by the miners themselves, and, in the absence of any complaints, they naturally would presume that no grounds for such existed. For such evils as we find, therefore, we think we have our own lethargy and indifference to blame largely; and we cannot doubt of receiving to a great extent, at least, such aid as we may reasonably ask.

H. T. Harding,
For the Committee.

At the regular meeting of the Association, on December 5, 1890, held at the Halifax Hotel, Mr. B. C. Wilson opened the discussion by referring at length to one point not covered in his original paper, viz., the uncertain state in which titles to surface rights yet exist under the Statutes of the Province. On motion of Mr. MacDuff, Mr. Wilson's remarks were incorporated in his original paper.

Mr. J. E. Hardman spoke at some length on the subject. The committee, he said, have recommended that in future all ungranted lands upon which gold has been discovered shall be reserved by the Government for mining purposes, and they shall "pass" with the mining lease. This is altogether desirable, but it seemed to him that the position recently taken by the Government, that no grants for lands upon which gold is known to exist shall issue without the consent of the owners of the mining leases, is broader and is a better solution of the difficulty and one which more completely protects the legitimate miner—of course it is only the legitimate miner that we are considering or can possibly consider. Let the Government take the same position with regard to all ungranted lands that they have taken with regard to the "revested" lands referred to, and let them take a step further and adopt the suggestion of the committee, that in *all* future grants there shall be provision for revesting such part or parts of such grants as shall be found to cover mineral grounds.

For the determination of the value of such revested lands, the idea of a Government Arbitrator (who possibly might also be the Inspector of Mines with advantage) was worth consideration.

He heartily concurred in the report of the Committee in preferring that this change be incorporated in the Statutes rather than be a recorded Order-in-Council; and he also endorsed the idea of having tabulated schedules or plans prepared by the Government, showing the location and boundaries of all grants in which the Crown has reserved no mineral rights. There was one case in Court to-day, and in six months there might possibly be two others, in which it was contended that the original grant conveyed the title to gold and other minerals, as well as to the soil; and in each and all cases the parties now owning had bought such property in good faith that the Government lease-title was a good one, and on the strength of it have spent thousands of dollars in opening and working mines thereon. It did not require sagacity to foresee one of two things, either the extreme embarassment of the Government in having sold what it did not own, or the complete and utter damnation of Nova Scotia gold mines in the eyes of capitalists and honest men.

He desired to state, in reference to the hypothetical case alluded to by Mr. Wilson, in his paper, that B. does get some sort of a recognition from the Mines Office, in the shape of a paper called a "Transfer." But A. apparently has no endorsement on his lease to show that he has sold or parted with the whole or any part. He was sure, however, that this could be easily remedied, through having the blank forms of leases slightly changed. To the characterization of the methods by which the office takes $200 per area on every surrender, he was sure they must one and all cry "Hear, Hear!" It was, as the document said, a decidedly dishonest practice.

There is another practice that he desired to refer to. Mr. Wilson spoke of it in language that was clear and admirable. He said: "Custom which has grown into power through use and precedent, without legislation," and, again, of "regulations which have no legal status beyond what they have acquired though *continued observance* and none *questioning their validity*." By Section 73 of the Mines Act, the course of the Commissioner of Mines is clearly laid down, when, in the case of *forfeitures*, he is unable to decide who is the first applicant for the same. He is, in such case, obliged to *sell* the areas applied for at *public auction*; certainly a mode of procedure which is for the benefit of the treasury of the commonwealth. But in the case of vacant ground, ground that has become vacant by expiration of lease, or has never been under lease, no special direction for the Commissioner's guidance is made. One would suppose that the method prescribed by statute for the one case would naturally govern the other cases, which are of similar nature. Not at all; this infamous "custom" steps in (probably the offspring of some defunct Commissioner, centuries ago, who was too indifferent to do otherwise), and prescribes that it is the regulation of the office that all such applicants for new ground must be united in a partnership in those areas, or at least in a co-ownership,—and thus washes its hands of all trouble. But, as Mr. Wilson says: "the Government has yoked those people together, but provided no means of divorce," unless some one of the co-owners kicks vigorously and goes into court to have such co-ownership dissolved by public sale. So that the Government, by sanctioning such a practice, really gives its approval to "customs" and "regulations," and practices which are illegal, inequitable and unjust, which have no warrant in law or equity, and which encourage expense, litigation and trouble, instead of striving to foster and aid one of the industries upon which their financial credit is based.

Such a case as he described was personally known to him, and not one, but several. That the Commissioner (and by the Commissioner he meant the Department of Public Works and Mines) should attempt without any warrant of law to force unwilling parties into an obligation, which was one of the most delicate of business relations, and one usually safeguarded by extreme preliminary care and caution, was of itself sufficient reason for demanding an immediate and explicit direction by statute of mode of procedure in such cases. But, there were too many of these customs and too little of the spirit of the law; the miner was beset on all sides, and bound with circumscribing cords, until his life was hardly worth the living. One solution, and one only, would cut all these Gordian knots and free the gold mining industry, so that it should have new and trebled life and strength, and that solution was fee simple. Once get this, and all other difficulties would vanish as smoke before the wind.

Mr. MacDuff, of the English syndicate, expressed himself as much interested in the subject. The owners of the property he represented lived in Europe, and he had found considerable difficulty in making clear to them some of the intricacies of our mining laws, and they naturally felt considerable interest in the validity and permanence of their titles; and he further made some comparisons between our mining laws and the more elaborate and definite statutes and regulations in Australia, where he had spent several years, and where the best mining talent and experience of the country had been employed to draft the statutes and administer the law, and considered that much of their legislation and practice might be introduced in Nova Scotia with advantage, and promised to favor the association, at a future meeting, with some transcripts and data from the antipodean colony. He endorsed the remarks of Mr. Wilson referring to surface rights, speaking of the ownership of tailings which were deposited on the surface of areas other than those owned by the mill owners, maintaining that the present lease gave right to all gold *upon* as well as under the surface. He advised the adoption, modified perhaps, of the Australian plan, of each owner voluntarily registering his tailings at the Mines Office, paying therefor a certain fee.

Mr. Partington referred to the necessity of a revision and simplifying of the mining laws and mines office practice, and instanced the objection frequently raised by capitalists and prospective investors in the United States, to what they considered the insufficiency of transfer titles and the manifest injustice of some of the regulations or requirements of the Mines Department. Referring to Mr. MacDuff's remarks regarding the ownership of tailings, he objected to this plan of registration, maintaining that the Government took enough money out of the gold miner already. He also maintained that under the statute, surface gold or alluvial mines should be taken up under a separate lease. See sections 1, 10, and 12, chap., R.S.

Mr. Hardman concurred in this construction of the sections referred to, and said it was a matter of doubt whether the wording of the lease and the words of the statute were not in conflict. The matter, if ever worth the while, would probably some day be referred to a court for construction.

Mr. Fisher said the Department had informed him that there was no conflict between the lease and the statute.

Mr. Stemshorn said the discussion showed that the mining law was faulty, as new points came up under it every time it was discussed. He, for one, had never known before of the distinction in classes of areas, as shown by sections 10 and 12.

Remarks were also made by Messrs. Reid, Harding, Archibald, McDonald and others.

President Stuart considered the matter one of vital importance, not only to the mining fraternity, but to the provincial welfare in general, and suggested that the papers and the expressions of the members of the Association present be compiled and printed for distribution, in order to induce a more general interest in the gold mining industry and its requirements, and if possible, elicit from practical mining men suggestions of needed amendments to the mining laws, and induce combined action by those interested,—which was unanimously approved.

It was also resolved that the Secretary send a copy, with the report of committee and discussion, to each member of the Provincial Legislature.

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The Copper Deposits of the Province of Quebec.*

Dr. R. W. Ells, Ottawa.

(Continued from page 34.)

On the east half of lot nine, range eleven, the Brome Mining Co. also sank a shaft sixty feet deep on a bed of variegated and vitreous ore in similar nacreous slates, of which it was supposed three feet of the rock would carry three per cent. ore. From this also no returns are available, and in the south-east half of lot seven, same range, explorations on a four foot band in chloritic slates yielded, according to Mr. Chas. Robb, a considerable quantity of ore.

In the adjoining township of Brome, mining was carried on at several points. On the east half of lot five of the fifth range, the yellow and variegated sulphurets were found in three bands, varying from two to thirteen feet thick, supposed to be repetitions of one and the same bed through undulations of the strata. Three shafts were here sunk by the Canada Copper Mining Company to a considerable depth, and a large quantity of ore, estimated at three per cent., extracted. Machinery for crushing and concentrating was erected, but the company soon ceased operations.

On lot six, range six, considerable exploratory work was carried on by the Bedford Mining Company, but with no satisfactory result. On the west half of lot twelve, range seven, the Tibbets mine, owned by Messrs. Ball and Morell, consisting of a shaft to the depth of eighteen feet was sunk on a band of yellow sulphuret in nacreous and chloritic schist. On lot six, range seven, the variegated ore was found in two bands, one of which, two or three feet thick, was estimated to carry one per cent. copper; the other band of five feet was supposed to cary one and a half per cent. ore.

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* Mineral Resources of the Province of Quebec, 1890.

On lot eighteen of range eight variegated and vitreous ores were observed to occur in four bands in nacreous, chloritic and epidotic slates, and dolomite in a breadth of several yards, and a small excavation, not sufficient for a test, was made. These ores were continued on lot nineteen, same range, and on lot twenty-one, range nine, but no returns as to value or output from any of these are to hand.

In the township of Shefford mining was carried on at two places only, viz.: by the Glencoe Mining Company, on lot seventeen, range two, where the different ores occur with quartz and calcspar in four separate bands in micaceous and chloritic slate and on lot twenty-eight, range three, by the Waterloo Mining Company, in similar ores, and with similar country rock, where a shaft was sunk to a depth of sixty feet, but no returns are available.

Furthur north in Stukely, the Grand Trunk mine was situated in the south-east quarter of lot six, range one. A shaft was here put down to a depth of sixty feet on a band of yellow and variegated sulphurets, in micaceous and chloritic slates with dolomite of the usual character. The same bed, with a thickness of three feet, was found on the lot adjoining; some good ore was obtained, but the quantity is unknown. A trial shaft, twenty-one feet deep, was also sunk by Messrs. Lambe and Shepherd in the south half of lot seven, range two, on a band of fifteen to twenty feet of dolomite, carrying disseminated yellow ore with pyrites.

On the south-east quarter of lot nine and the south-west quarter of lot ten, range six, vitreous sulphuret occurs in chloritic sandstone associated with quartz, felspar and chlorite; masses of pure ore being obtained of from three to twelve pounds weight. On the latter area the Logan mine was located, in which from four to five tons of twenty per cent. ore were obtained.

On lot seven, range eight, two parallel bands of dolomite carrying vitreous sulphuret occur, with a breadth of twenty-three and thirty-six feet respectively, separated by about a hundred and seventy-five yards of micaceous and chloritic slates. The ores are intimately associated with veins and strings of quartz, calcspar. chlorite and epidote. A shaft was sunk for sixty feet and a crosscut driven twelve feet across toward the vein to the west but did not reach the ore. On the north-east half of lot six, range nine, a shaft was sunk for one-hundred and forty-two feet in a slate band, carrying similar ore to the last, without satisfactory results, and on the south half of lot four, tenth range, a shaft twenty-two feet deep was sunk in order to cut a band of eighty to ninety paces, in which four cupriferous bands occur. No returns from any of these are available.

Tracing this belt to the north, we have, in Melbourne, several deposits of copper ore, for the most part in green chloritic rocks and micaceous schists. On these deposits three mines have been in operation, viz., the Ryan Hill, the Cold Spring and the Balrath. The first is situated on lot two, range two; the ore is the variegated and vitreous sulphuret in chloritic slates; the size of the band not being stated. At the Cold Spring mine, lot six, range two, some shafting was done, the ore occurring in narrow bands over a considerable breadth, but presumably not in sufficient quantity to be economicably valuable. At the Balrath mine, on lot two, range four, the ore, which is of the kind just described, is said to occur in a series of bands, eight in number, ranging from one and a half to five feet in width, in one of which a shaft was sunk, which disclosed some rich bunches of ore. Considerable exploratory work was also done on lot eight, range one, in the shape of pits and trials shafts, on a deposit of yellow sulphuret; the copper being mixed with magnetic and specular iron ore, in a gangue of quartz and calcspar, cutting quarzite and talcose slates. None of these areas appear to have yielded very much copper. In Cleveland, across the St. Francis River, variegated and vitreous ores also occur, with similar chloritic rocks, at a number of places. The only locations worked to any extent, however, were on lot twenty-five, range twelve, at the St. Francis mine, and at the Jackson mine, on the south-west quarter of lot twenty-six of range thirteen. At the former place, in addition to the usual ores already mentioned, green and blue carbonates are said to occur with a little native copper; the whole contained in a lode three feet thick. A shaft was here sunk for 195 feet, and levels and other works driven for 513 feet along the lode, from which a large quantity of ore was taken, which, according to Mr. Bennett, the manager, ranged from six to twenty-six per cent.

At the Jackson mine a shaft was sunk to a depth of twenty feet, the ore being found in a lode of a foot in width, with other larger veins carrying ore in smaller quantity at no great distance. The amount of ore extracted from either of these places is not known.

In Shipton, copper ores are comparatively rare, at least in so far as known, and not in quantity apparently sufficient to warrant mining operations; but in Halifax the variegated and vitreous ores are again quite extensively distributed, the rocks being of the same character of schists as in Melbourne. Mining was carried on at two places, viz., by the Halifax Mining Co., on lot ten of range three, where a considerable mixture of different ores was found in a vein from eight inches to three feet in width, on what is known as the Halifax mine, and visible gold was reported in a quartz vein which was cut. Considerable work was done here by shafts and adits, but no returns as to the amount of ore obtained are to hand, though no large bodies of ore were found. At the Black Lake mine, on lot nine, range nine, some exploratory work was also done by Dr. James Reed and others, but nothing of importance was encountered.

In Chester, although exploratory work was carried on at a number of points, the most important location probably was that in the south-east half of lot eight, range six, known as the Viger mine. Here the ore was principally the yellow-sulphuret in quartz veins, and vitreous ore in the slates. The veins were scattered through a width of 170 feet and were opened at a number of points, from which a considerable quantity of ore was extracted, but involving a large outlay and much work. No deposits of large size were met with, and the explorations, after a very thorough trial, were found to be unprofitable. The metalliferous veins on this property extend across into the adjoining lot, but their size was insufficient to pay for the labor involved in their opening. On lot nineteen, range ten, the Austin Mining Co. made a couple of openings, one on a two-feet vein, the other on one of six feet, but the ores were found to be not sufficiently concentrated in the gangue to pay for extraction. Explorations were also made on lots eleven and fourteen of Craig's Road range, in variegated and vitreous ores in limestones, but without success, as well as on lot five, range six, where a quartz vein from two to four feet thick was observed, which presented some good specimens of ore, but the quantity was too small for successful mining.

Ores similar to the last are found at several points in Inverness, occurring in micaceous, chloritic and nacreous slates or schists, but, in so far as known, no attempt at mining these was made, though one of these localities was among the first recommended for trial in 1847. In Leeds, however, in addition to the great Harvey Hill mine, very fully described in the Geol. Can., 1863, several other deposits were worked, notably, that on the fifteenth lot of the fourteenth range, in close proximity to the Harvey Hill deposit, the ore veins and beds from which were supposed to be continuous in this direction.

The ores are all vitreous, variegated and yellow sulphurets occurring in beds or veins in what have been styled nacreous slates, and, on the lot just mentioned, were owned by the English and Canadian Mining Co. Native gold was found in one of the ore veins. Not far distant from this, to the north-east, in that part of the seigniory of St. Giles known as the Handkerchief, the Chaudière Mining Co. opened up several quartz veins, of which eight were exposed in a breadth of 1,100 feet, two of which had a thickness of two to three feet, and could be traced for 1,200 to 1,500 feet.

About $5,000 were spent in these explorations, but owing to difficulties of various kinds, the work was shortly abandoned. Fine specimens of ore were obtained here, and the quartz is reported by Dr. Reed to have yielded him native and visible gold.

What was regarded as the eastern limit of the second belt was the seigniory of Ste. Mary, where ores similar to those just described occur in red and green slates near ferruginious dolomite, not far from Ste. Mary's Church. From the aspect of the strata, it would, however, almost appear as if this deposit should be more closely related to the red slates and dolomite of the first area. Another mine at St. Sylvester, referred to in the report of the Geol. Survey for 1866, was that of Ste. Margaret. It was opened by the late Thos. Glover, of Quebec, by whom a company was formed in New York, styled the St. Margaret Mining Co. Several shafts were sunk with an expenditure of about $5,000, the amount of ore obtained being about fifty tons. The ore was mostly the variegated sulphuret, the country rock consisting of purple slates, green grits and quartzites. The mine was owned by Mr. Cromwell, but the ore appeared not to be in sufficient quantity for profitable extraction.

The most important of the mines in this section is that so widely known as the Harvey Hill, now the Excelsior, on lot seventeen, range fifteen of Leeds. This location, according to a paper by Mr. Herbert Williams read to the Literary and Historical Society, Quebec, 1865, was the second discovered in the province as carrying copper, the first found having been at Inverness. These discoveries did not appear to awaken very great interest for some time, and Dr. James Douglas seems to be the first who appreciated their value, and through his agency the Megantic Mining Co., was formd for the purpose of exploring and working the copper deposits of Megantic County. Upon the discovery of the Harvey Hill deposit, the location was secured by this gentleman and his associates, who organized a company under the name of the Quebec and St. Francis Mining Co. But little further investigation was however, undertaken by any others than by this company, who explored the Harvey Hill property in such a way as to bring it prominently to the notice of English capitalists, and by these a new company was formed in 1858, under the name of the English and Canadian Mining Co., by whom operations were commenced and carried on with varying success for a number of years. The history of the workings of this celebrated mine for some years is given in the Geol. Can., 1863, with considerable detail. From this we learn that the ores occur in two ways, first as a series of interstratified beds, of which three were clearly recognized, varying in thickness from 6 inches to 6 feet, or possibly more, and second, in quartz lodes or veins, composed of quartz, calcite, pearl-spar and chlorite, some of which carried the variegated and vitreous ores; others carried copper pyrites, in places in very rich pockets. The veins, which sometimes cut across the bedding, were exceedingly rich in certain parts, and in others comparatively barren, so much so that in actual value as a source of supply for copper, the beds were considered the more important. In these the various ores were disseminated through the body of the slates, generally in lenticular masses running with the bedding. These masses were generally small and thin, sometimes having a thickness up to three-fourths of an inch, with a length of six to twelve inches, in addition to scattered grains of the ore through the slate beds; the amount of copper in all being estimated at from three to five per cent.

The hill upon which this mine is situated was pierced by a number of shafts from twelve to forty-five feet deep, as well as by an adit and tunnels; the whole forming a very extensive series of workings. The principal adit was driven into the hill across the measures to a distance of 1,488 feet and intersected the several ore beds, the upper one of which had a thickness, when first worked, of three feet, which, in the lower workings, increased to ten feet and was estimated to carry five per cent. ore. From a prospectus issued by the Consolidated Copper Co., of Canada, limited, in 1872, the subsequent history of this mine is given to that date. The surface works of the company, including much of the plant, were destroyed by fire in 1866 with an estimated loss of £20,000, owing to which operations were suspended till 1870, when Mr. James Douglas, one of the proprietors, took over the work again and resumed operations in the mine. The quantity of ore raised from the commencement of operations in 1858 to the end of 1862 was 322 tons of thirty per cent. copper, in addition to 1,000 tons at the surface of two and a half per cent. and 500 tons of four to five per cent. from the upper bed. The figures as to the output for the different years, as given by Mr. H. Williams, the manager, are as follows:—

	Tons.	Cwts.	Qrs.	Lbs.	
1858.........	9	15	0	2	Of 30% copper.
1859.........	43	7	0	21	
1860.........	104	5	3	0	
1861.........	70	4	1	6	
1862.........	94	17	2	21	
1863.........	113	20	3	14	Of 26% copper.
1864.........	235	12	3	4	Of 20% copper.

The mining ton = 21 cwts., or 2,352 lbs.

The falling off in the value or percentage is attributed to the fact that during the last years the mining was confined principally to the beds and not to the quartz leads. The ore in these beds was found by Mr. Williams, upon careful examination, to occur in lenticular masses, as already stated, varying in thickness from one-sixth of an inch to two or three inches, and in length from three to eighteen and even twenty-four inches. These masses overlapped each other and were disseminated throughout a thickness of five to six feet. This refers to the overlying or upper bed, which appears to be the one principally worked. For 1865 the figures for the output appear to be wanting, but from the report of Mr. Harold Douglas, superintendent of the mine, as given in the prospectus of the Consolidated Co. mentioned, it appears that for a part of 1866, in which year the works were destroyed, 265 fathoms of ore were taken from the bed, dressed to twenty-four per cent. and sold in Liverpool for $35,420, at an average of fifteen shillings per unit. From a paper by James Douglas, jr., of Quebec, in the Lit. and Hist. Soc. of that city, 1870, in discussing the several beds from which the supply of ore had been principally derived, he considers that "there is no likelihood of these beds being of such great extent or of such uniform richness as was at one time attributed to them."

The work of Capt. Williams on the main or upper beds showed that where quartz lodes cut the beds, deposits of ore, often of considerable size and great richness were struck; that the beds gradually became less rich in copper as they were worked away from the lodes which had all along been supposed to derive their supply of ore from the beds with which they were associated; but certain features observed in driving an inclined shaft on a lode, reached from the Kent shaft, induced a change of belief in this respect, the evidence there presented going to show that the beds derived their supply of copper from the lodes by percolation into the contiguous slates, and subsequent operations appear to have confirmed this view.

The most important probably of the different lodes struck in the several shafts is that known as the "Fanny Eliza." This entered the bed near the intersection of the Kent shaft, and on this lode the greatest amount of work appears to have been expended. Where first struck, near the shaft, it was of small size, but rapidly widened as it was opened. Mr. Douglas says of it: "The lode is from twenty to twenty-four inches in width, and very regular, both in dip and strike, which is slightly to the west. The ore, as it comes to the surface yields from eight to twelve per cent. copper. It separates, in crushing, very perfectly from the gangue, and is therefore easily concentrated to form forty to fifty per cent. It consists of a mixture of grey and purple sulphurets. When the lode enters the bed it carries a good deal of yellow and no grey ore, but the yellow entirely disappears in depth. The ore occupies the centre of the lode, whose matrix consists of calcspar, some quartz and a good deal of bitter spar, in the composition of which iron replaces part of the magnesia.

"Tracing the lode upward, but beneath the bed and beyond the spot where it first attracted attention, it is seen, in the thirty feet cross cut, as a well-defined lode of about eight inches wide, but carrying very little copper, and has been reached by a level driven upon it from the bottom of Kent's shaft, where, however, it is thin and irregular, though highly charged with copper." From Mr. Douglas' paper we learn, further, that to the east of the Fanny Eliza two lodes enter the bed, on one of which some work was done. The lode runs parallel with the Fanny Eliza, and like it increases in size in the direction of the dip, but diminishes towards the rise. He says, also, that "the beds gradually decrease in richness in proportion to their distance from the lode." Mr. Douglas also maintains that the Fanny Eliza is a true lode maintaining its width and direction for forty fathoms with a regular dip, and holds that the veins which take their rise in the roof of the bed are also lodes and not lenticular masses. The vicinity of the lodes is indicated by an increase in the richness of the slates and the kind of ore which they carry.

These mines after having been idle for some years, have lately changed hands and are now being worked by the Excelsior Copper Co.

From the notes of Mr. C. W. Willimott, who visited the spot in 1882, we learn that the mine closed work in 1879; operations being confined principally to the Fanny Eliza lode, or vein, and in the level and incline which had been sunk to a distance of 600 feet, some rich pockets of ore had been found. The mines, in 1882, were owned by a New York company, but no work, other than taking the water out of the shaft, was going on. The Excelsior Copper Co., have been carrying on work during the last two years, but have not extended their underground operations to any great distance, having cleared the shafts of water, repaired the timbering and the buildings, and erected a smelter, in which a considerable quantity of the ore lying about had been reduced, the coke for this purpose being obtained from Nova Scotia, the limestone from Dudswell, and the iron from McVeity's mine near Kinnear's Mills, but no returns of output nor of other results are to hand. The present manager is Col. Drew Gay.

On lot sixteen, range fourteen, adjoining the Harvey Hill property to the north, the Leeds Mining Co. began operations in 1863. These were carried on for a couple of years, in anticipation of meeting the extension of the rich lodes and beds of the Harvey Hill mine, but in this their expectations were not realized, since the extension of these beds to this property was not found sufficiently rich in copper to pay for mining. These works were suspended in 1865. They were under the general supervision of Mr. Herbert Williams, and no attempt has since been made to develop the property.

The second range of mines in what was, in 1863, regarded as the eastern portion of the second synclinal, or that area east of the Sutton Mountain ridge, included those of Potton, Durham, Brome, Bolton, Oxford and Brompton. The rocks here, in places, differ markedly from those of the area just described, being very frequently black and other colored slates, with great areas of serpentines and diorites, but the character of the ore is, in some cases, similar to those from the west side of the Sutton ridge, though in certain of the mines some features which are different are presented.

In the township of Potton, the yellow sulphuret is the most abundant ore, the vitreous being rarely found. The rocks here are mostly slates and diorites with serpentines; the copper pyrites are largely mixed with iron pyrite, much of which is the magnetic variety or pyrrohotite. In no case yet observed in this township is the quantity of ore sufficient to warrant any great outlay in exploration, except, possibly, at the recently discovered mine on lot twenty-eight, range nine, on the west side of the Hog's Back Mountain, owned by the Memphramagog Mining Co. This mountain is a mass of diorite, rising to a height of about 800 feet above Lake Memphramagog, and surrounded on both sides by black and bluish grey slates. The deposit of ore, which is principally a pyrrohotite with a small quantity of copper pyrites, occurs on the west side, at the contact of the diorite and slates, in a bed of fifteen to eighteen feet thick, which extends along the side of the mountain for several hundred yards. It dips north-west at an angle of about forty degrees, having the diorite for its foot wall, and the surface above the vein and for some distance beyond is covered with a heavy bed of bog iron ore. The ore, in places, contains a considerable quantity of a dark colored or almost black calcite. On this vein several pits have been sunk at intervals along a distance of 1,000 feet, and, according to the manager, an inclined shaft has been put down on the vein for eighty-five feet. A cross cut has also been driven with the vein, so as to drain the pits. About 800 tons of the ore have been extracted and piled waiting for shipment. From several assays by Dr. Wyatt, of New York, and by Torrey and Eaton, the ore contains, from different samples:

	Per cent.
Iron	30 to 50
Copper	2.80 to 5
Sulphur	37.75 to 42

A peculiarity of this ore is the readiness with which it spontaneously ignites when piled in heaps exposed to the weather; a feature not common to the ores from most of the other locations.

This mine is situated at 700 feet above the lake, connected by a good road of a mile in length with landing stage, and good facilities for shipment, either to Magog or Newport.

In Bolton, the township adjoining to the north, the extension of the slates and serpentines is found, and mining operations were carried on quite extensively for some years at several points. Probably the most important of these was the celebrated Huntingdon mine, on lot eight, range eight, and the Ives mine, a couple of miles further north, on lot two, range nine, and lot four, range eight.

In the former, the ores are mostly copper pyrites, mixed with the magnetic pyrites or pyrrohotite, a large deposit of which occurs in chloritic slates in contact with serpentine and diorites. A band of more than three feet of solid granular copper ore occurs near the serpentines of the west side of the veins. A section of the metalliferous portion, going eastward from the western wall of serpentine is as follows:—

	Feet.
[*]1. Greenish diorites with disseminated masses of copper pyrites and magnetic iron pyrites	2·0
2. Compact granular copper and iron pyrites with disseminated masses of quartz	1·4
3. Magnetic iron pyrites, interstratified with thin leaves of chloritic and mica schist	0·9
4. Greenish diorite with disseminated copper and iron pyrites	1·0
5. Compact granular iron pyrites, with disseminated small masses of quartz	2·6
6. Green chloritic slate, with disseminated masses of copper pyrites, mingled with iron pyrites	8·0

Work was begun on this property in August, 1865. From notes kindly furnished me by Capt. W. Warne, the present manager of the Memphramagog Mining Company's works, the management was in the hands of Capt. Bennett, of Lennoxville, who controlled operations till 1870-71, when the mine was sold to a Glasgow company and the name changed to the Huntington Copper and Sulphur Company, under the management of Mr. John Rudda of Cornwall. The output under the old company's management is stated to have been from 200 to 300 tons of ten per cent. ore per month, part of which was shipped to England and part to the United States. Extensive buildings, etc., were erected, and under Capt. Rudda's management, the output was increased to from 400 to 500 tons per month of seven per cent ore.

In 1872, works were erected for carrying on the Longmaid or Henderson process, by which the ore was burnt in retorts to drive off the sulphur, but the process did not apparently meet with much success. The ore was then crushed, mixed with common salt, and calcined in furnaces and placed in vats with hot water and acid from the tower, and run off into other vats containing scrap iron, by which the copper was precipitated. Hundreds of tons of precipitate, containing 65 to 75 per cent. of copper, are said to have been made in this way.

In 1873, the works were destroyed by fire, with a loss of $75,000.

They were partially re-built, and mining was carried on in a desultory fashion for several years, and the company finally closed operations in 1883. During the past year the property has passed into the hands of Messrs. G. H. Nichols & Co., of Capelton. In the working of this mine, two deep shafts were sunk, one to the depth of between 500 and 600 feet, called the Huntingdon shaft, the other known as the Wright shaft, 200 feet deep. North of the Huntingdon mine on lot six, range eight, were the works of the Canadian mine, presumably on an extension of the vein just described. Two shafts were here sunk, one to a depth of 100 feet, the other 50 feet, and some ore shipped to Capelton. The mine subsequently passed into the hands of the Eastern Townships Bank, and has not been worked for some years. Further north, on lot two, range nine, Bolton, the Ives mine was situated. Two shafts were here sunk the Ferrier and the Galt, the former to a depth of about 60 feet, the latter for 100 feet. This mine was opened in 1866, and worked for ten years, and a large quantity of from 10 to 14 per cent. ore was extracted and shipped to England. These three mines are situated on the east side of the Missisquoi River, south of what is now known as Eastman, and are all probably located on the same belt of ore.

The serpentine rock is found at all these mines, with slates of various colors, differing, in this respect, from the rocks of the second area, or that west of the Sutton Mountain. Very favorable reports on these deposits have appeared by Dr. T. Sterry Hunt and others. but the presence of the magnetic pyrites serves to distinguish the ores as a class from those already described.

The copper deposits of Orford Township were mined at several points. On lot nine, range A, yellow sulphuret occurs in a dioritic rock, near serpentine, of which six veins are found in twenty-five feet. This was exploited by Messrs. McLeod and others. On the third lot of range F, and on the eighth lot of the same range, similar ores, with a like association of rock matter, were found, but at none of these does systematic mining seem to have been carried on.

At the King mine, on the third lot, range thirteen, variegated ore, associated with magnetic oxide of iron, occurs in a four-foot band of dolomite and serpentine; and on the west side of Brompton Lake, on the east side of a high hill, called the Carbuncle, composed of diorite and serpentine, several small openings were made, from which in all about twelve tons of twelve per cent. ore are said to have been oqtained. The difficulties of working this depôsit, from its comparative inaccessibility, must have been very great, and the quantity of ore in the rock appears at present very limited, although a five foot vein of solid yellow sulphuret is reported to occur there. This mine was styled the Carbuncle Hill mine, and was located in the second lot of the fourteenth range of Orford. In the township of Brompton the only mine worked was on lots twenty-eight and twenty-nine of range nine, where the ores, which were of the variegated and vitreous varieties, were found in serpentine. According to Mr. Chas. Robb, the principal deposit was in a five foot vein, containing, according to his report a promising quantity of ore. It has, however, long since been abandoned.

(To be continued.)

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[*] Geol. Rep., 1866, p. 35.

Annual General Meeting and Dinner of the Gold Miners' Association of Nova Scotia. Important Amendments to the Mining Law Discussed.

The Annual General Meeting of the Gold Miners' Association of Nova Scotia was held in the Halifax Hotel, Halifax, on Tuesday afternoon, the 10th instant, Mr. J. M. Reid, of the Oxford Gold Mining Co., Musquodoboit Harbor, in the chair. The following office bearers were elected for the ensuing year: President, Mr. J. M. Reid, Musquodoboit Harbor; Vice-President, H. T. Harding, Truro, N.S.; Secretary, H. M. Wylde, Halifax; Executive Council, John E. Hardman, S. B. Oldham, B. C. Wilson, Waverley; George Stuart, Truro. The following were elected honorary members: Sir William Dawson, Montreal; Mr. H. S. Poole, F.G.S., Stellarton; Prof. H. T. Hynd, Windsor; Hugh Fletcher, B.A., Ottawa; E. R. Faribault, C.E., Ottawa.

Mr. B. C. Wilson, Waverley, chairman of the comitttee on mining laws, read his report, in which were embodied the following suggested amendments to Chap. 7, Revised Statutes of Nova Scotia.

SECTION 2.—Amended by striking out the 2nd, 3rd and 4th lines as far as "afternoon," and substituting therefor, "at ten a.m. and closed at four p.m., time of the 60th meridian, except on Saturdays, when it shall be closed at one p.m.

SECTION 5.—Amended by striking out these words in 5th and 6th lines, "from time to time as may be deemed necessary," and by inserting after the word "inspect" in 6th line, the words "at least annually."

SECTION 6.—Amended by striking out "shall not" in 6th line, and by inserting after the word "and" in the 6th line, the following, "and they shall not, nor shall Mining Surveyors nor any employee of the Mines Department, be directly or," &c.

SECTION 10.—Amended in the first line so as to read, "all mines of gold, or of gold and silver, shall," &c., &c.

SECTION 11.—Amended to read, "areas shall be laid out, as far as possible, uniformly and in quadilateral and rectangular shapes. Surface measurements of areas shall be horizontal, and each area shall be bounded by vertical planes passing through the horizontal surface lines."

SECTION 12.—To be repealed.

SECTION 13.—Amended by inserting after the words "full" in the 8th and 12th lines respectively, the words "*with their address.*"

SECTION 14.—Amended by adding after the word "number" in the 4th line, "he shall also mark upon said plans all grants of land in which the mineral right has been granted with the fee."

SECTION 17.—Amended by adding the following to the section, "and the date of every such lease shall be the date of the application for said lease, and no other date shall appear *within* the lease, but the date of registration may appear upon the outside or cover of the lease."

SECTION 27.—Amended by striking out the whole of the first line and substituting the following: "All leases shall be in perpetuity provided the yearly rental is paid thereon, and provided also that all the covenants of the lease are kept and fulfilled, but," &c. Also by adding to end of section, "nor shall such lessee be entitled to any priority in applying for a new lease."

SECTION 73.—Amended, by inserting after the word "chapter," the following: "Or the lease thereof shall have lapsed and expired or terminated, and also in the case of simultaneous applications for leases on vacant ground, by two or more applicants."

The following new sections to be added:—

SECTION —. The Commissioner of Mines shall also cause to be established, within three months after application for the same by any lessee or licensee, in all proclaimed districts and also all unproclaimed districts where at least 100 areas have been applied for, a *base line* of not less than four hundred and fifty feet in length to be laid off along the course of the lodes as nearly as may be practicable. Such *base line* shall be marked at its two ends or termini by substantial, permanent and accessible monuments of stone or iron, with bench marks cut thereon or affixed thereto, and all areas shall be laid off from this *base line* by lines parallel to the same or at right angles to it, or its course prolonged; and any person removing, altering, obliterating or defacing such monument or monuments, or any mark thereon, shall forfeit a sum of not less than one hundred nor more than five hundred dollars for each offence, to be recovered in the name of the Commissioner in the same manner as an ordinary debt.

SECTION —.—No lessee shall mine within ten feet of the boundary line of his lease or on any vein or lode found therein, but he shall leave a barrier of unwrought county-rock of at least ten feet in thickness between his workings and his boundary; and no opening shall be made in this barrier without the consent in writing of the lessee of the adjoining area or areas, under penalty of not more than one thousand dollars nor less than one hundred dollars for each offence, to be sued for in the name of the Commissioner; and the party injured by such unlawful working or mining shall have an action at law, in addition to the penalty, against the offender for all damages incurred by or consequent upon such unlawful working or mining.

SECTION —.—In all sales of mines of gold or of gold and silver involving change of ownership, either in whole or in part, a transfer as now executed and recorded shall be conclusive evidence of such sale or change of ownership, and the Commissioner shall also affix to the lease or leases of such transferred areas a certificate under his seal, setting forth the fact of transfer and the names of the purchaser or purchasers, and he shall charge a fee of one dollar for each and every certificate so affixed.

In cases where the holder of any lease shall sell any certain number of areas less than the whole number of areas contained in such lease, and shall retain the balance of said areas himself, the several portions thus becoming separate and distinct properties, it shall then be the duty of the Commissioner, upon presentation of the original lease, to issue new leases in the names of the new owners, which new leases shall bear date corresponding to the original lease and which shall have, acquire and hold all the conditions and privileges of the original lease; and for each lease thus substituted the Commissioner shall charge a fee of $1, but no rental charge of $2 per area shall be made as in the case of an application for a lease.

On the motion of Mr. John E. Hardman it was resolved: That the report of this Committee be confirmed as the sense of the Gold Miners' Association of Nova Scotia; that it be committed to the Executive Council of the Association with instructions to present same to the Governmeut and House Committee on Mines and Minerals, and to secure amendments to the Mines Act as far as they may be able. The meeting then adjourned.

The annual dinner of the Gold Miners' Association of Nova Scotia took place on Wednesday evening, March 11th, 1891, at the Halifax Hotel, and was attended by a large number of the members of the Association and their friends. The chair was occupied by the President, Mr. J. M. Reid, of the Oxford Gold Mining Company, Musquodoboit Harbor. On his left sat Hon. W. G. Frye, Consul General of the United States, and on his right was Hon. W. S. Fielding, Provincial Secretary. Among the other guests were Hon. J. W. Longley, Attorney-General of Nova Scotia, Prof. J. G. MacGregor, of Dalhousie University, Mr. H. S. Poole, F. G. S., manager of the Acadia Coal Co., Stellarton, Mr. S. M. Brookfield, Mr. C. J. Wylde and others. After partaking of a most excellent *menu* served by Messrs. Hesslein & Sons, the chairman called the company to order and proposed as the first toast of the evening, "The Queen," the whole company in response singing the National Anthem. The next toast proposed by the chairman was, "The President of the United States."

HON. W. G. FRYE, Consul General of the United States, responded. He thanked the Association for the hearty manner in which the toast had been received, and was exceedingly glad to be present at this merry gathering. He felt obliged to confess that what he did not know about mining matters would fill the biggest library that has ever been seen, but he could say truly that he was becoming deeply interested in the question of gold mining in Nova Scotia. In making his official reports on the resources of the province, he had not failed to observe from year to year the progress which had been made in gold mining. (Applause). He remembered the extent of the output in 1882, which was the first year he had spent in Nova Scotia, and when some time afterwards he left his official position here for certain reasons which it would be quite unnecessary to dilate upon (laughter), he took away on that vacation very strong impressions of the value of the gold mining industry of the province, and on his return to Nova Scotia again these impressions were further strengthened, because he soon became aware that the development of that great industry had gone on increasing (hear hear), and in the last report which he had made he stated that gold mining in Nova Scotia was one of the staple and substantial industries of the province. (Applause). He had not heard of any great bonanza in connection with any of the gold mines of the province, but from his own observations he was in a position to testify that gold mining was one of the really prominent industries of Nova Scotia. He remembered seeing some years ago in the *Chronicle* office of this city some slabs of gold quartz with the gold sticking out of them like a sore finger, so to speak. (Laughter). He was glad to meet so many miners, and could assure them that he watched the progress of the mining industry with great interest, and if there was anything which he could do in any way to promote their interests he would be only too glad to undertake it. (Applause). He sincerely wished that friendly relations would always exist between this country and his own, and furthermore, he could not help adding, without desiring to introduce political questions into this matter, that he hoped the governments of the two countries would agree to some trade arrangement whereby the people on both sides of the line could be better accommodated than they are now (applause), and secure freer and better relations as to business and friendly intercourse between the people of the two countries. (Applause). It was evident from the language adopted by a portion of the Nova Scotia press that some Nova Scotians did not understand the position of the United States people, and perhaps he might concede that there were some persons in the United States that did not really understand the people this country. It was evident that in some sections of this province a certain prejudice existed against Americans. It reminded him of the prejudice which used to exist between the North and South in his own country. A young fellow from Kentucky happened to visit Washington for a few days. He was a good young man, but had not travelled much, and had somewhat vague ideas as to some of his countrymen. He met a few friends from his own district who were then at Washington, but he did not meet many others on his trip. On his return home he was asked who he had seen at Washington, and he replied: "Well, there was a delegation from Kentucky, and a few people from Virginia, and there was a gentleman from Maryland and another gentleman from Ohio, and a fellow from New York (laughter) and a son of a gun from Massachusetts." (Laughter). Perhaps if a certain type of Canadian were reporting the addresses here to-night, and was subsequently asked who was here he might say: "Well, there were several gentlemen from Nova Scotia, and a few gentlemen from New Brunswick and a gentleman from Ottawa, and lastly, a son of a gun from the United States." (Laughter). It was a great pity that the people of the two countries did not know each other better, because with better knowledge and closer intimacy all prejudices would disappear. Personally he was profoundly interested in the progress of the gold mining industry in Nova Scotia, and he hoped sincerely that the members of the association would prosper, and always strike it very rich. (Applause).

The Chairman next proposed as a toast:—"The continued prosperity of our Fair Province," and coupled with the toast the name of Hon. W. S. Fielding, Provincial Secretary of Nova Scotia.

HON. MR. FIELDING said that he felt bound to acknowledge the fact that in the gold mining industry, as in many other industries in Nova Scotia, the Province was indebted in a very large degree to American capital and American enterprise. (Applause.) It was a pleasure to know that our neighbors across the border were not indifferent to the resources of Nova Scotia, and he sincerely desired that they might find profitable investments for their capital in this province. Nova Scotia had immense resources which if properly developed could not fail to make the province a very rich and prosperous country. Although this province was not pre-eminently an agricultural country, it should not be forgotten that there are in Nova Scotia agricultural sections wich will compare favorably with any portion of North America. He need only refer to the fertile valley of Annapolis, the valley of Margaree and the splendid stretches of land in the Musquodoboit Valley. In the matter of mines Nova Scotia was pre-eminently rich. In regard to the coal mining industry, represented at this gathering by his friend Mr. Poole, the province had good reason to boast of the progress which had been made in the development of that industry. As to the iron mines of the province it seemed as if we were just beginning to properly appreciate their enormous value, and he believed that the day was not far distant when Nova Scotia would take first rank as one of the iron producing portions of the continent. (Applause.) In reference to gold mining, that enterprise used to be regarded as having a decidedly speculative element in it, but there was ample reason now to rejoice that the pursuit of gold mining had ceased to be highly speculative, and had settled down and become one of the solid and substantial industries of the province. (Applause.) From the very nature of the enterprise there would always be more or less of a speculative character in it, but, as his audience knew, there were a large number of instances in which gentlemen engaged in gold mining, in this province, had in recent years made large sums of money, not by the selling of gold mines, but by the working of gold mines and by honest industry and perseverance. (Applause.) We hope to be able to show the people of this continent and the people of Europe, that gold mining is an honest and legitimate enterprise, and affords as fair a return for investment as can be had in any part of the world. (Applause.) In addition to other valuable resources, Nova Scotia could proudly boast of her great fisheries. There was no coast line so rich as the coast line of Nova Scotia. Our province possessed great wealth in her soil, her forests, her mines and her fisheries, and all that was required was a population of enterprising, intelligent and progressive people, having faith in the resources of the province. With such a population the future of Nova Scotia would be a bright and prosperous one. He had listened with pleasure to the remarks of the United States Consul. Why was it that on occasions like this a toast was always offered to the President of the United States? Why do we not toast the Emperor of Germany, the President of France, or the King of Spain? They are all foreign countries. But many of us recognize that the neighboring Republic is not absolutely a foreign country, but that these neighbors of ours are bone of our bone and flesh of our flesh, speaking the same language and possessing the same glorious traditions, and our desire should be to draw them near to us and to encourage a feeling of neighborliness and amity. While we desire to retain our allegiance to our old flag, and they retain their allegiance to their own, we yet should desire to live in friendship, and to cultivate harmonious relations, in the fullest confidence that with such relations we shall bring about our prosperity and their prosperity, and promote the happiness of that great race to which we all belong. (Cheers.)

THE VICE-CHAIRMAN, MR. B. C. WILSON, in rising to propose the next toast, dwelt humorously on the tenacious character of the disease called gold fever which so many of the audience were suffering from. A person once contracting this fever was rarely cured afterwards. It was not intermittent in its character, and although a sufferer might imagine that he was actually convalescent, and had really shaken off the complaint, and could look upon the gold when it was yellow, the fever was bound to break out again at certain seasons of the year. (Laughter.) The newspapers had lately been filled with statements about loyalty. There was an intimate association between loyalty and "royalty," and it was clear that gold miners who were committed to "royalty" must necessarily be devoted to loyalty. (Laughter.) The gold miner was so far committed to royalty that he contributed two per cent. of his profits to royalty, and for that reason could claim that he manifested a fair per cent. of loyalty. (Laughter.) Without any further observations he proposed as a toast "The success of the mining industries of Nova Scotia," and coupled with the toast the name of Mr. H. S. Poole.

MR. H. S. POOLE, in responding to the toast, said that the ordinary avocation of a miner was calculated to make him cautious before he acts, and should also have the effect of making him cautious before he speaks. He himself was naturally of that disposition, and when he first received the honor of an invitation to this gathering, he hesitated about leaving the quiet life he was leading in the grimy neighborhood of the mines to accept the invitation. He almost felt inclined to think when he first received the invitation that the Association might desire some countenance with lugubrious aspect to sit at the funeral meats of some legislation that had gone amiss. (Laughter.) He knew that on a previous occasion there had been presented a bill of fare which required the digestion of glycerine, and as he came from a neighborhood where King's Cordial was prepared, he might be considered in a position to discourse as to the efficiency of that cordial. (Laughter.) The industry with which he was directly connected was not the gold mining industry, but the coal industry, nevertheless he could say that coal managers took a lively interest in the progress of the gold miners' enterprise, as the more gold that was produced the more the coal owners were ready to receive. (Laughter.) The carrying on of coal mining was extremely hazardous and attended by constant risks, and of course there was not much opportunity for those engaged in it to develop much literary and oratorical ability. There was still living, however, a man in England called the pitman poet, a Mr. Skipsey, and some lines written by that remarkable man might appropriately apply to the recent disaster which had occurred at the Springhill mines, and which had caused such widespread bereavement and sorrow. The poem in question was entitled "Get Up," and was written at a period when the miners were obliged to begin work at a very early hour each day.

> "Get up, the collier calls—get up;
> And in the dead of night
> I rise a weary wight,
> I take my bite and sup,
> My mining clothes I don,
> My birds I kiss,
> And then I whistle as I shut the door
> I may not ope again." (Applause.)

Mr. J. E. HARDMAN rose to propose the next toast and said: It is well known that the pursuit of gold mining required as essential qualities, sound discipline, keen observation and inflexible endurance. The occupation of a gold miner was continually beset with difficulties which often made them wish that they knew a little more. Gold miners could not have too much education. Nova Scotia was a glorious province, and the Hon. Premier had properly and eloquently extolled its magnificent resources. But more active development of these resources was absolutely necessary. In gold mining, instead of an output of half a million dollars a year, we should produce five millions annually. (Applause.) In this province the people were dependent on foreign capital to some extent for the development of their mineral wealth, but the people of Nova Scotia should not be dependent on foreign capital at all. There was enough hidden wealth in Nova Scotia to place the province ahead of any other portion of the continent if her resources were only fully developed. (Applause.) Proper technical training and education were the great factors in successful mining operations, and he wished now to propose as a toast "The Science Teachers and Educationists of our Province."

PROF. J. G. MACGREGOR of Dalhousie University, in responding, said that he was gratified at having the opportunity of dining with the Gold Miners' Asssociation. He presumed that he was honored with an invitation to this pleasant and interesting gathering because he represented an institurion of science. With regard to that Institute he could truly say that the Gold Mining Association had its best wishes and its warmest sympathy, and that a great portion of the efforts of the Nova Scotia Institute of Science were directed to investigations concerning the development and fostering of the gold mining industry in this Province. (Applause.) Very recently the Institute had taken a step which he believed would meet with the approbation of all the members of this Association. As was well known the Geological Survey had been doing excellent geological and topographical work in Cape Breton, the scale of a mile to an inch having been adopted there. At present the surveys in Antigonish and Pictou Counties had been completed admirably and a very large amount of detailed information had been obtained. With regard to these Counties it was proposed that the scale should be reduced from one mile to the inch to a scale of four miles to the inch, and in many cases a map of that description would not adequately represent the amount of work done, As it was of the utmost importance that these maps should embody all the information we possessed, and should present any new information that might be obtained, the Institute of Science had agreed to petition the Dominion

Government to continue the publication of the maps on the scale of one mile to the inch, and use throughout Nova Scotia the same scale as had been adopted in Cape Breton. (Loud applause). He suggested that the Gold Miners' Association should endorse the step taken by the Institute of Science, so that all these maps would be published in such a form as would be most useful to the mining interests of the country. (A voice—"We have already done so," and applause). No one was more ready than he to welcome visitors to this Province from the United States, but he would like to feel that in regard to the mining industries of the Province we were doing more for ourselves and were not so dependent upon our friends on the other side of the border. (Applause.) Very few of those Nova Scotians who were doing good work in mining operations in this Province owed their success to training received in the schools or colleges of this country, but he thought he could say that those gentlemen who have come from the other side of the border owe their success to the training and knowledge which they had received in the technical educational institutions which flourished in the United States. The question therefore might properly be asked: Were the school teachers and science teachers in Nova Scotia doing their duty, and were the citizens doing their duty in this regard? He had lately been endeavoring to find out the men in this province who should have a special knowledge of geology and mineralogy, and he had been surprised to find how few men there were here who had special knowledge of these important subjects. In other countries numbers of men in cities and towns could be found who had their interests in these subjects stimulated by a special course of scientific training, and who, although in after life devoting themselves to other avocations, have nevertheless maintained a lively interest in these studies. In the Nova Scotia schools there was no adequate teaching of science. There were no endowments essential to the proper carrying out of technical studies of this kind. It was impossible for our school teachers as a general rule to be well versed on these matters under the circumstances, and even our colleges were behind-hand. Some of the professors were sacrificing their whole lives in order to do all they could to promote these studies, and instead of teaching one or two branches have now consented to teach five or six important branches. He was inclined to think that these gentlemen would do far better for themselves if they were to restrict themselves to one or two subjects, but in the interests of their scholars they grapple with five or six branches. A great many people expected that Dalhousie College should do a great deal in this direction, because of the endowments she possessed; but it should not be forgotten that these endowments were tied up, and were intended to be devoted only to the teaching of particular subjects. In the United States, 15 or 20 years ago, there was no institution where a student could have gone to perfect himself in these technical branches; but now if a student applied to him for advice as to where to perfect himself in these branches he would send them to the United States. In that great country enormous progress had been made in that respect, and the people had thoroughly recognized the vast importance of the study of science. There were two prominent members of the Nova Scotia Government present this evening, and he felt assured that if the people of the country showed that they appreciated the necessity for further advancement in the study of science the Government would be prepared to act upon any reasonable suggestion emanating from any portion of the people. If the Gold Miners' Association would assist the Institute of Science and others in spreading throughout Nova Scotia the absolute necessity of more scientific training they would be doing an admirable amount of good for the whole province. (Applause). Although the authorities at Dalhousie College felt their hands somewhat tied by the restrictive character of their endowments they had nevertheless determined to assume extra work, and had recently resolved to try what could be done to start a technical department. (Applause.) At present there was a science course in which the student received a training in pure science, but the authorities of the college had lately determined to remodel that course, so that it should be much wider in its range, and leading engineers in Halifax had intimated their willingness to second our efforts in that respect. (Applause). These assurances enabled the authorities of the college to announce that they would be able during the next year to offer to the young men of Nova Scotia a course not only in pure science, embracing geology and chemistry, but also a course in civil engineering mining engineering, and possibly metallurgy. If the student would in addition spend his summer in the workshop, or with an engineer, he would thus obtain all the elements of a thorough training. A strong effort should be made to spread throughout the community the conviction that a more thoroughly scientific training is essential, and the Gold Miners' Association would be rendering a valuable service to the province by spreading such ideas far and wide. (Applause.)

Mr. McDuff proposed the toast of the Press, which was responded to by Mr. C. F. Fraser of the *Critic*, Mr. J. M. Geldert of the *Chronicle*, and Mr. B. T. A. Bell of the REVIEW. Mr. Fraser in the course of a very forcible and eloquent address, said that in regard to gold mining in this province he believed that we had but scratched the surface, and that ultimately the great second pay streak would be found in this province. (Applause.) He considered that the government should offer a bonus to the man who strikes the second pay streak. (Hear, hear.) A proper assay was badly needed in the province, and its establishment would be of immense benefit to all those engaged in the gold mining industry. The Press of this province should by its influence, and constant utterances, seek to convince the people of this country of the immense wealth that is lying at their doors, and in succeeding in making the people appreciate the enormous mineral wealth of the province, the press will have accomplished a great duty pregnant with enduring service to the country.

Mr. B. T. A. Bell proposed the health of the guests of the Association, and coupled with the toast the name of Hon. Attorney-General Longley.

Hon. Mr. Longley replied in an extremely witty speech. Brief, but very pleasant speeches were also made by Mr. Jas. Eisenhauer, ex-M-P., for Lunenburg county, and Mr. S. M. Brookfield.

Mr. C. F. Fraser proposed the health of the Gold Miners' Association, which was suitably responded to in a few graceful remarks from the President, Mr. J. M. Reid.

The toast of the Bar was responded to by Mr. W. B. Wallace and Mr. H. M. Wylde, and Mr. Willis eloquently replied to the toast of the Ladies.

The very pleasant proceedings terminated by the whole gathering singing Auld Lang Syne.

Low Grade Ores and Electric Transmission of Power.*

BY JAMES BRADY, C.E., M.E., VICTORIA, B.C.

GOLD QUARTZ.

Two dollar auriferous quartz, when found in large veins or lodes, can now be mined and milled in California at a profit. When this branch of mining was first entered upon in that State, fifty dollars per ton gold quartz was about as low grade as could be mined and milled profitably, and thirty dollar rock was thrown aside. This was owing to the cost of labor and the other factors of production, imperfect machinery and methods, and profound ignorance of the business. Managers and superintendents were without knowledge, practical or technical, and the mining and metallurgical engineers brought from abroad, were years in learning to adapt themselves and their methods to the widely different circumstances that prevailed here. Failures were the rule, and for many years idle quartz mills and abandoned mines were to be seen all over California. This was not due to the poverty of the mines, but to the circumstances above enumerated, and hundreds of quartz mines, abandoned in early days, have been re-opened within the last five years or so and, with improved machinery and under competent management, are paying large dividends: and gold mining is today as safe and profitable a business as farming, fruit growing, commerce or any other pursuit in California.

SILVER ORES.

The same remarks apply to silver and silver bearing base metal mines. Owing to the great improvements in mining, milling, concentrating and smelting machinery and plant, the application of electricity to the transmission of power, and the increased knowledge possessed by our mining engineers, superintendents, foremen and men, of the proper methods of mining and beneficiating the ores, it is a fact that concentrating ores of the above character, yielding an average of only $5 per ton in value of silver and base metal combined, can be mined and reduced on a large scale, at a fair profit, in localities where water power can be had, and where water or railroad transportation can be reached within. a few miles, and $10 silver bearing concentrating rock will pay almost anywhere that machinery can be brought in to work it, provided the vein is large (say over 10 feet wide) and can furnish from 100 tons upwards per day of such ore.

GOLD QUARTZ MILL, AND MILLING.

The modern gold mill is usually built in such a situation that the ore can be delivered by car or waggon at the upper part, where it is dumped against an inclined "grizzly," and the finer ore, passing through the interstices of the grizzly, falls directly into the main ore bin. The coarser ore (too large to pass through the grizzly) is screened off by gravitation into the coarse ore bin, from which it is drawn, by gravity, directly into the rock breakers or it falls upon a floor in front of the rock breakers; by these it is crushed and falls into the main ore bins.

From the main ore bins the ore passes through gates into the "self-feeders" which supply it automatically to the batteries. Quicksilver is fed at intervals to the mortars of the battery, and coming in contact with the native or "free" gold of the finely crushed ore, forms with it an amalgam. This amalgam is caught partly by the copper plates in the battery, and partly upon the amalgamated, or silver plated copper plates on the apron and in the sluice boxes outside, after it has issued through the screens of the mortar. The amalgam is "cleaned up" periodically and retorted. Retorting consists in the sublimation of the quicksilver, the vapours of which are condensed in water and the quicksilver collected; the residual gold is in a porous state; it is melted with fluxes in crucibles and cast in ingots. The pulp from which the free gold has been extracted by amalgamation passes over concentrators of various mechanical devices; these concentrators effect a separation of the auriferous sulphurets from the worthless gangue. In California the concentrated sulphurets are treated by the chlorination process. In some other sections of the country the sulphurets are sold to the smelting works.

AURIFEROUS SULPHURETS.

The gold ores of California carry, on an average, 2% of sulphurets. The concentrated sulphurets assay on an average from $60 to $90 per ton in gold, with from a trace to several dollars in silver. The Custom chlorination works in California charge $20 per ton of sulphurets (about 40 cents per ton of quartz before concentration) for treatment, and return 90% of the assay value. Under conditions ordinarily favorable, a plant treating 6 to 9 tons per 24 hours, can reduce the sulphurets at a cost of $8 to $10 per ton, extracting 90 to 94 per cent. of the assay value of the gold.

SILVER MILLING ORES, FREE AND REBELLIOUS.

Silver milling ores are either "free" or "base," and the latter require a preliminary or chloridizing roasting. The free milling ore passes through the same process as gold ores until the battery is reached. The ores are crushed wet in the battery, but battery amalgamation is not practiced. From the battery the pulp passes through sluices into settling tanks where the superfluous water is drained off. The pulp is then shoveled into the pans where salt and bluestone or other "chemicals" are used. Here the ore is first ground and then amalgamated. After several hours the pulp is run into settlers where it is diluted with water, and the heavy amalgam and quicksilver settles to the bottom; this is then collected and strained and the dry amalgam retorted.

Base or rebellious silver milling ores contain too much sulphur, arsenic, antimony, etc., to be treated by free milling process. After crushing in a rock breaker, they require a previous chloridizing roasting to adapt them to the pan-amalgamation. They are dried before the stamping and then stamped dry. The mortars have double discharge. The pulverized ore discharged through the screens of the mortars is carried by conveyers to elevators which lift it to the furnace floor. There are several types of furnaces in use, notably the Buckner, the White & Howell, the Stetefeldt, the O'Hara and the ordinary reverberatory furnace. The time of adding salt depends on the mineralogical character of the ore. When there is much arsenic or antimony present, salt is economized by a preliminary oxidizing roasting of the ore. The salt is crushed either separately or with the ore. It should be thoroughly incorporated with the pulp. To obtain a high degree of chloridation, sufficient sulphur must be present to effectually liberate the chlorine of the salt. Calcspar, braunspar, and fluorspar, etc., retard the chloridation by absorbing a large part of the sulphuric acid produced. Minerals containing arsenic, antimony, tellurium, selenium, etc., increase the loss of silver arising from volatilization. Zincblende requires long roasting to convert it into sulphate. The subsequent process of amalgamation is similar to that described with reference to the treatment of free-milling ores, though the grinding process is usually omitted or curtailed in the pan-amalgamation of roasted ores.

CONCENTRATION.

A modern concentrating mill encloses a good many forms of machinery by which ores are prepared for subsequent metallurgical treatment. The operation of concentration and dressing is based on the difference of specific gravity of the mineral constituents of an ore, by virtue of which the minerals have unlike velocities in falling through water or other medium. Water is preferably the separating medium. The coarse crushing of the ore is done by rock breakers, and the "screenings" or coarse stock from the rock breakers is further comminuted by rolls or stamps. But for this purpose rolls are preferable, inasmuch as their use minimizes the amount of slimes incident to crushing.

From the rolls the ore passes into the first (largest and coarsest), of the series of five revolving screens or "trommels." The trommels are either cylindrical or conical in form. In the former class the conveyance of the "screenings" from the delivery end to the discharge end of the trommel is effected by the inclination given to the axis of the trommel. In the latter class this is attained by virtue of the conical shape of the trommels, the screenings drop through "spouts" into the jigs, which have sieves corresponding in mesh to those of the delivering trommels. The trommels have sheet iron receiving aprons into which the ore falls after passing through the perforations of the screens. Through these aprons the ore is delivered to the next finer sieved trommel of the series.

The ordinary type of jig is a trough-shaped water box divided into two compartments by a partition extending part way down. In one of the compartments is a loosely working plunger operated reciprocally. In the other compartment is a fixed horizontal screen on which the sized ore is fed.

The strokes of the plunger cause a pulsation of water through the sieve. The ascendant current raises the mixed particles, which, in their descent through the water, arrange themselves in layers.

The sorting of the "equal falling" minerals takes place in a series of inverted pyramidal boxes called "Spitzkasen." Water is brought to each compartment from above by a pipe, which, discharging the water downward against the bottom of the box, produces an ascending current. This ascending current prevents the deposition of the lighter particles, which are consequently carried over into the next box of the series. These boxes are so arranged as to cause a slowly flowing current throughout the series.

Where the system of hydraulic classification is more extended, a series of boxes is used under proper conditions as to size, velocity of current produced, &c., for the

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[*] Paper read before the Annual Meeting of the Provincial and Dominion Land Surveyors, Ottawa, February, 1891.

separation of the sands. From these boxes the slimes retained in the current go to the slime classificators.

When jigging is not practicable, on account of the extreme fineness of the slimes, the pulp is worked on round tables, buddles, percussion tables, Triumph & True Vanners, &c. A sizing is effected by these machines. The largest particles (specifically lighter), being acted upon more readily by the flowing water, are carried down the inclined planes and pass away as tailings, while the smaller (specifically heavier) particles remain as concentrates.

SMELTING.

Argentiferous lead, and other base ores, concentrated and unconcentrated, are smelted in water-jacket blast furnaces of from 30 to 60 tons capacity per day of 24 hours, with reverberatory furnaces for roasting or matting refractory ores. The fuel used is charcoal or coke, or a mixture of both. The consumption of charcoal, when used alone, is from 20% to 25% of the weight of the smelting mixture, and that of mixed fuel from 15% to 20%. The waste in charcoal amounts to about 12½%. One cord of ordinary pine will make from 400 lbs. to 450 lbs. of charcoal. The fluxes commonly required are silica (quartz, sandstone, &c.), limestone and iron ore. Some ores have to be roasted and melted into a matte in a reverberatory furnace, before being smelted in the blast furnace, while others, such as carbonates of lead, and lead ores associated with a sufficient amount of oxide of iron, &c., can be smelted without flux or preliminary roasting and matting. When ores are obtained from many different mines, combinations can be made that will require no foreign flux.

Under the most favorable conditions as to ore, fluxes, fuel and labor, the most docile ores may be smelted for from $3.00 to $4.00 per ton; but under unfavorable conditions may run as high as $18.00 or $20.00 per ton.

WATER POWER.

The Treadwell Mine, Douglas Island, Alaska, is said to have the largest quartz mill in the world. All the machinery, consisting of 240 stamps, 96 concentrators, 12 ore crushers, &c., requiring about 500 horse power, is run by a single wheel seven feet in diameter, under a head of about 500 feet, making 235 revolutions and using 630 cubic feet of water per minute through a nozzle 3.31 inches in diameter; with a 4-inch nozzle this wheel will work up to 735 horse power. Perfect regulation is afforded by the use of a deflecting nozzle operated by a hydraulic governor. The nozzle is about 4 feet long with a ball joint at the butt end, and to the discharge end is attached, by lever connections, an automatic hydraulic regulator, which varies the amount of water applied to the wheel as may be needed to adapt it to varying loads—a device which affords a peculiarly simple, sensitive and satisfactory regulation. With such an arrangement, and in such a location, the advantage of water power is conspicuous. Thus the wheel above mentioned weighs but 800 lbs., and the entire equipment, embracing shaft, boxes, driving pulley, &c., only about 4,000 pounds. On the other hand, a steam machinery plant, to give the maximum capacity of such a wheel, would not weigh less than 200 tons, and the expense of running such a plant would be almost immeasurably greater

LOW GRADE ORES AND WATER POWER.

The Star Mining and Reduction Co., of Fresno County, California, furnishes a good example of low grade concentrating ores worked by water power. This company has a lode 150 feet wide, with thousands of tons of quartz on the surface, carrying galena in bunches, stringers, &c., and worth from $10.00 to $20.00 per ton in lead and silver. This ore is concentrated to about 60% lead, 60 oz. in silver, and $3 to $4 in gold, at a cost of $1.25 per ton for mining and transport, and 50 cents per ton for concentration.

The plant consists of one mammoth Blake Crusher, Cornish Rolls, screens of different fineness, German jigs, &c., in a building 136 by 60 feet, 68 and 45 feet high, stone foundation. The ore is conveyed from the mine to the concentrating mill by means of a Halliday Wire Tramway 7,000 feet long.

The capacity of the concentrating works is 125 tons in 24 hours; and the building and machinery are so arranged as to permit of this being doubled. The total cost of the plant was $40,000.

ELECTRIC TRANSMISSION OF POWER.

It has been only about two and a half years since the attention of mine operators was first called to the practicability of electric transmission of power, and the advantages of substituting, by this means, water power for steam, where water power can be had within any reasonable distance; and where the conditions were such as not to admit of a direct application. Great interest has been awakened in this subject, and rapid progress made in its development, as the following examples will show.

The Roaring Forks Electric Light and Power Co., of Aspen, Colorado, affords a very interesting application of water power to the production of electric energy, and the convenient and profitable use made of it in mining operations. This was one of the first attempts, on a scale of any magnitude, to operate the various machinery required in mills and mines by electric transmission, and the success that has attended the venture has attracted wide attention.

The power plant consists of eight 24 inch Pelton wheels, 1,000 revolutions, 820 feet head. Capacity 175 horse power each wheel. Total horse power 1,400. Single line of pipe 500 feet of 16 inch and 3,500 feet of 14 inch diameter pipe.

The power is made to conform to the requirements of the machinery run, by the use of reducing tips, so that only as much water is applied to the wheels as is necessary to run the machinery to which they are attached. Each wheel runs a separate dynamo, the connection being made by belt direct.

Close regulation is afforded by means of deflecting nozzle and hydraulic governor attached to each wheel. The station is running 120 arc lights of 2,000 candle power each; also 2,000 incandescent lights 16 candle power each, distributed over an area of some 4 miles square, and used for lighting streets, hotels, stores, private residences, &c., and in the mines, mills, and sampling works in the vicinity.

The electric power plant consists at present of one 60 horse power Sprague Motor, and six 20 horse power Sprague Motors, which furnish power to underground pump, hoists, tramways, sampling works, &c., at distances varying from one to two miles from the station.

The wheels weigh about 90 lbs. each, and (including shafting, pulleys, boxes, gates, nozzles, &c.) the proportions would be four and a half pounds of material to every horse power developed.

The relative proportion in the best type of steam plant would be from 400 to 500 pounds of material to every horse power. This plant has been in operation for more than a year and works in every way satisfactorily.

THE ASPEN MINING CO., COLORADO.

Capacity 200 horse power, transmitted three miles; running pump, hoist, tramway, &c. Started up about June 1st, 1890. Reports entirely satisfactory.

CAROLINE MINING CO., OURAY, COLORADO.

Two Pelton wheels; capacity 400 horse power; head 525 feet. Power transmitted three and a half miles through two strands of 00 wire, ground return. Machinery to be operated, 1 Knowles pump, 750 feet lift, 30 horse power hoist, 100 ton concentrating mill, 1 sawmill.

ECONOMY OF WATER POWER AND ELECTRIC TRANSMISSION.

The Dalmatia Mine, El-Dorado Co., Cal., owned by a London sydicate. The vein is a huge mineralized dyke of porphyry with quartz seams: and is opened by tunnel and shafts which cut the ore body 200 feet deep. A cross-cut 190 feet long has not reached the wall. The ores are mined by contract and delivered at the mill for 7½ cents a ton. This is made possible by reason of the large body of ore and its loose character.

The mill is equipped with three Huntington mills, crushing 25 tons a day each, and 10 stamps, crushing 25 tons a day, making the capacity 100 tons in every 24 hours. The ore is mined and milled for 50 cents a ton. This economy in the working of the Dalmatia Mine ores is due to the fact that this property enjoys the distinction of being the first quartz mine in the state run by electricity.

The plant consists of 1 Pelton wheel, 7 foot, using 400 miners' inches of water under 112½ feet head. One electric generator of 126 horse power connected with Pelton wheel two small wires to mill, one mile away, connect with electric motor or dynamo in the mill. From pulley or dynamo a belt carries the power direct to main shaft. The company are going to connect another 20 stamp with the same wires, and run it with the surplus power, making their capacity 150 tons a day.

The mill has a complete electric light plant, with turbine wheels, etc.

A 30 foot fall will drive a dynamo, and the same water can be used continually as it flows down the river. In this way power can be made on any stream to drive all the mills within miles.

The electric transmission of power reduces the cost in every instance. It allows the placing of the mill in any locality. It overcomes the difficulties attending the operating of a mine where wood and water are scarce. It saves all the expense of water for boiler, and fuel for heat, etc. There is scarcely any limit to the possibilities attending the use of electric power in mining.

Mine Discipline.*

By Peter Hormel, Essen, Pa.

In reading the accident reports of the Mine Inspector, from year to year, you will see that they treat principally of carelessness. You will see, almost from the beginning to the end, that the accidents are caused by lack of discipline and the carelessness of either the miner, the driver, the trapper, the fire boss, the superintendent, or the operator.

In most of our mines there is little or no system of discipline, and I consider it a reproach to the mining industry that so little is done to strictly enforce the rules and regulations and thereby to better the condition of the mines.

Some of you, no doubt many, will say, "that is not the case at our mine. We have a set of rules printed and framed and hung in the office or at the pit mouth, and every man receiving employment is requested to read them. We have plenty of supplies on hand at all times, and our mines, in regard to roads and ventilation, are in good condition. What lack we yet?"

Let me ask you, friend, would not the general condition of your mine and its discipline make a very poor picture in the eyes of a shrewd observer? Are you not deceiving yourself into a false sense of security?

The word discipline, in a general way of speaking, covers education, training, and government, and its enforcement by correction or punishment.

Let us consider these points briefly. Education is one of the principal means of discipline. As mining is a science, it should be learned in its different branches by all, from the boy at the door to the engineer draughting the plan of the mine, and the more educated, practical men you have the better results you will obtain in operating. When you show men how they may obtain the best results with the least labor, and insist that they do so, you have made a long step toward good discipline.

Again, training is very important. A mule may be ever so well broken to outside work, but when he is taken into the mine, you will have to train him over again before you can haul coal with him. It is just so with a man. Let him be ever so good a worker, yet he will have to be trained to mine coal, to set posts, to lay road, to watch his slate, and handle his lamp carefully in gaseous mines. Upon the last much depends, and good discipline is required to accomplish it.

One of the most difficult duties which a mine boss has is the governing of the mine, and it is often the case that a man who holds a first-class certificate cannot govern men at all.

We often see in families around us that a man who cannot govern himself seldom has obedient and well-behaved children, and things about his house generally show the lack of firm management.

It is just so with a mine. If the government is good the mine boss and the other officials will be respected and their orders obeyed and the mine will be in good condition because the men will have an interest in its success.

History tells us that a well-disciplined army will put to rout and overcome double its number of undisciplined soldiers. So in a mine under good discipline much more work will be accomplished than in one that is not well governed.

Even under the best discipline rules will sometimes be disobeyed, but generally kind words and a request not to do it again, or at most, a good firm lecture will be sufficient to keep things in order. On the contrary, under poor discipline, cursing and swearing and discharging the offender will often only aggravate the tendency to disobedience.

I do not mean to say that kind words and requests will always result in good discipline. Sometimes it becomes necessary to inflict punishment, but in such a case it should be well thought over and never be done hastily, and only when it is necessary to show that you mean what you say. A boss should be careful to say just what he means, and not, as is often the case, say one thing to-day and another to-morrow, showing that he is as changeable as the wind and hardly has any will of his own.

I have thus far given a brief definition of mine discipline and I hope suggested some thoughts, on which some of the abler members of the Institute may write more fully. I will now compare two mines, one having good discipline, and the other poor, or none at all.

When you visit the first mentioned mine, as soon as you come as far as the tipple you will see that everything is kept in good order. You will see no rubbish lying about the place. The supplies on hand will be all sorted and kept in order and the tools in the proper place, and you can see right away that matters are well regulated as far as the outside is concerned. When you enter the mine you will find everything, including the roads, drains, and rooms, in good order, every one busy and the miner careful and obedient to all the orders of the mining boss. If you ask the mine boss a question he will answer you promptly and correctly, for he knows all about his mine and the working places of his men.

On the other hand where there is poor discipline you will see at once by the way things are lying about that there is no good housekeeper there, and if something should go wrong, you will see the men hunting around for their tools, and one will say to another, "Where did we use them last?" and if any one knows, they will find them in that place if they have not been stolen in the meantime. This is a very costly way to keep things, as the time keeps going on.

You will usually find the mine boss outside and when he sees you coming he will make a show of his authority by bossing his men about needlessly, but the men know him and do not mind him. He will have a great deal to tell you of what a good man he is, but as you go into the mine your eyes will tell you much more.

Perhaps you will meet a man, we will say the roadman, he will ask the boss, "Did you see anything of John?" The boss will say, "No, I did not." After a little you will meet John, the helper, and he will say, "Did you see anything of Mike?" The boss will say, "I saw him a little while ago." John will say, "I have been hunting for him most of the day." I might say much more in this line, but the most of you have seen the picture before as there are many such mines in Western Pennsylvania.

Now some one may say, I have tried hard to have good discipline at my mine, but failed. My friend, let me whisper one thing in your ear. Start with yourself, control yourself, govern your temper and set a good example, and I am sure you will succeed. A good motto comes to my mind, and that is: "Be sure you are right and then go ahead." Davy Crockett, the author of these words, was a poor hunter and trapper, but by energy and the practice of this motto became a member of Congress. Fellow hearers, if we only had plenty of Davy Crocketts as mining bosses, with his motto of being sure they were right before they began anything, and with energy to push it ahead when they did begin, the science of mining would be far ahead of what it now is, and the poorly disciplined mines and mine bosses would be few and far between.

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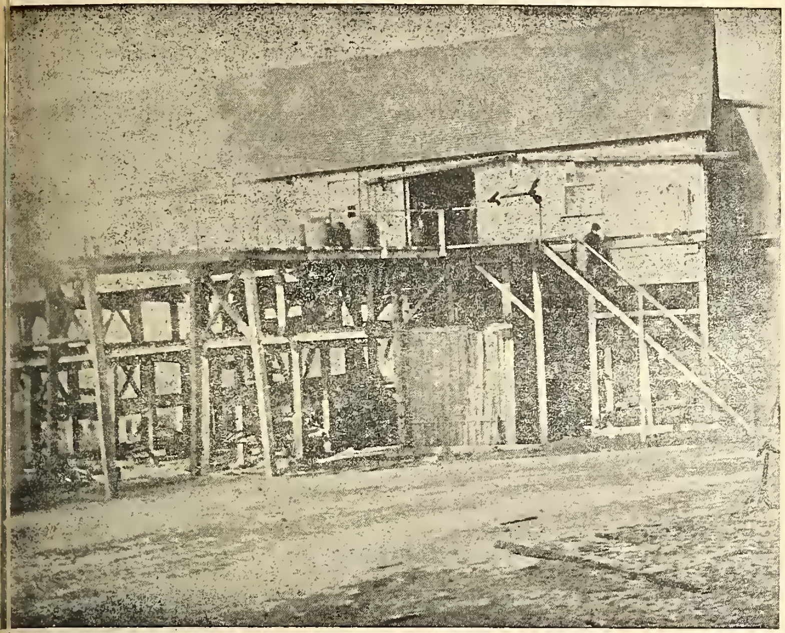
* Transactions of the Western Pennsylvania Mining Institute.



THE EAST SLOPE, SPRINGHILL COLLIERY—THE SCENE OF THE EXPLOSION.

THE TOWN OF SPRINGHILL FROM THE COLLIERY.

Our Portrait Gallery.

[A series of portraits and biographical sketches of Canadian mining engineers, mine managers, inspectors, geologists, explorers, etc.]

No. 10.

The Late Henry Swift, Underground Manager at Springhill Colliery—Killed February 21.

The late Henry Swift, Underground Manager of the Springhill Collieries, was born at Bickerstaffe, Lancashire, England, in 1850. He met his untimely death in the faithful discharge of his official duties by the colliery explosion on February 21st. By this terrible mining disaster, 124 of the men and boys employed in the pit at the time under Mr. Swift, were either killed by the explosion or suffocated by afterdamp.

Mr. Swift was a self made colliery manager. The chief industry of his birthplace was coal mining ; his father was engaged in mining, and his death, when Henry was about eight years old, made it necessary that his sons should support their widowed mother. The opportunities of young Swift were limited. He attended, for a brief period, the National School at Bickerstaffe, where he obtained an elementary training, which developed within him a taste for knowledge that, in after years, he lost no opportunity of improving. At twelve years of age, he entered the employ of the Ramford Coal Company. This Company operated several collieries in Lancashire, leased from Lord Derby, father of Lord Stanley of Preston, Governor-General of Canada.

When about eighteen years old, Mr. Swift was employed as chain-runner in No. 10 shaft, which took fire. In this emergency he distinguished himself by his coolness and courage, in vain attempts to extinguish the fire. He stood at his post, up to his knees in water, till called out by the Inspector of Mines. One of the companions of his youth, Christopher Hargreaves, who was with him at the fire in No. 10 shaft, was also employed under Mr. Swift as underground manager in No. 2 slope at Springhill. They were firm friends, and to Mr. Hargreaves the Review is indebted for these reminiscences of Mr. Swift's boyhood. For some time after this event, Mr. Swift was engaged in the sinking of shafts at various places, until, at the age of nineteen, he crossed the broad Atlantic to engage in mining on this continent. With several young companions he took passage on the steamship *City of Brooklyn* to New York. After their arrival they proceeded to Pennsylvania, where Mr. Swift worked as a miner in the anthracite mines. He soon tired of this, and removed to Maryland, and shortly afterwards to Pictou County, Nova Scotia. There he also worked as a miner for several years.

About 1874, Mr. Swift came to Springhill. He first worked as a miner, and then as a shiftman. He worked hard, and by dint of close application to details, mastered his business, and won the good opinion of his superiors. He was promoted to the position of overman, and had charge of No. 3 Slope. Next he was elevated to the position of underground manager under Mr. Hill, whom he succeeded in April, 1890. Mr. Swift was a plodding student, and was well read in mining subjects. His mining journals were preserved and substantially bound. He was eminently methodical and practical, and frequently contributed to the columns of mining journals. A posthumous letter from him signed "H. S." appeared in the March number of the *Colliery Engineer* relating the experience of a sulphur man with gas and damp. Mr. Swift was most active, and up to the time of his death spent the greater portion of his time underground every day.

THE LATE HENRY SWIFT, UNDERGROUND MANAGER AT SPRINGHILL.

Some idea of the responsibility devolving upon the manager of the Springhill Collieries—the largest in Canada—may be conveyed, when it is remembered that the daily output averaged 2,000 tons, and frequently exceeded that quantity. From 1,300 to 1,400 men and boys are employed. To superintend such extensive operations and control successfully such a small army of workmen, requires more than ordinary administrative ability.

Mr. Swift manifested a deep interest in the welfare of his workmen, and was ever ready to lend a helping hand to an ambitious young man. A few days before his death, he presented to the library of the Miners' Lodge a number of books on ventilation, the nature of gases, and other subjects of interest to the men. When the Board of Examiners for Colliery Officials was established, Mr. Swift was one of the first to apply for a certificate of competency as underground manager, which he obtained after a most satisfactory examination. He was recently elected Vice-President of the Nova Scotia Institute of Mine Officials.

Mr. Swift was married at the Albion Mines, N.S., in 1871, to Miss McLeod His wife and five children survive him. He was a member of the Masonic order, by whom he was buried with impressive rites. Mr. Swift was a member of the Presbyterian church, and for many years was secretary of the congregation. He was appointed a Justice of the Peace by the Provincial Government about ten years ago. He took an active part in the formation of a Relief Fund for the benefit of sick and injured workmen, of which society he was president. He was a man of broad sympathies, and though he led a busy life, did what he could for those who were unfortunate. His untimely death is deeply mourned by his employers, whom he faithfully served, and by many who esteemed him highly as a warm hearted friend.

The Prussian Fire-damp Commission.

Following is a summary of the report of this Commission, which was appointed to enquire into the causes of mine explosions, more particularly in regard to the explosiveness of coal dust :—

Results of the Neunkirchen Experiments.—Contrary to the English and French experiments, which had only been carried out in narrow tubes or pipes, the German Commission made an endeavor to effect its experiments under circumstances analogous to the practical working of the mine. The seat of the experiments was a horizontal gallery, 51m. in length, 1·72m. in height and 1·20m. in breadth. The middle of the gallery was improved by elliptical iron bands and and lined inside with wood ; one end of it terminated in a solid mass of masonry, and the other extremity remained open. A small perpendicular gallery of the same transverse dimensions was afterwards added, for the carrying out of a few isolated experiments. Inside the masonry were carefully laid in different directions seven cast iron pipes, and a captive blower in the Kœnig mine furnished the natural gas which was required either in a pure or in a mixed state. In proportion as the experiments advanced fresh questions presented themselves, so that at the conclusion of its labours the Commission was still unable to pronounce definitely on all points ; nevertheless, certain essential conclusions were established with sufficient clearness to allow of a solution of the principal question, and the way pointed out which must be followed in subsequent experiments that may be undertaken to set at rest still remaining difficulties. The principal results of the Neunkirchen experiments have been summarised in the following manner :—

1. With ordinary air all coal dusts are absolutely without danger in presence of a naked light. This harmlessness still remains, even with 4 per cent. of CH_4 in the atmosphere, although if the coal dust be raised in clouds a considerable elongation of the flame is perceptible. With more than 4·5 per cent. of CH_4, and with certain sorts of dust, the presence of a naked light causes an explosion ; and with 5 per cent. of CH_4 the explosions are incomparably more violent than with 6 per cent. of CH_4 without dust.

2. In an atmosphere free from gas, the firing of a gun, charged with ordinary gunpowder (230 grammes) and with a tamping of clay, produced a length of flame from 3 to 4 m.; with a tamping of a mixture of rock and coal dust the flame increased to 5 m. in length, and with a tamping exclusively of coal dust from 9·50 m. to 16 m., according to the quantity of coal used. The nature of the coal dust appeared to have but little influence on the length of the flame.

3. The presence of coal dust within the radius of an explosion greatly increases the force of it, and with certain sorts of dust an explosion may result even in the absence of firedamp. The coal dust found in closest proximity to the flame showed particles of coke on its surface, and sometimes cakes of coke, whilst the amount of volatile gases in the coal dust was greatly diminished. The degrees of fineness of the chemical composition of the coal make themselves felt in a remarkable manner, and during the experiments it was found that (*a*) coals containing less than 10 per cent. of volatile matter are almost entirely free from danger, and elongate the flame but a very few metres ; (*b*) coals consuming from 10 to 16 per cent. of volatile matter elongate the flame to 25 metres and perhaps further ; (*c*) smith coal, containing from 16 to 24 per cent. of volatile matter, resulted in a flame, which in the gallery, extended as far as the coal dust had been scattered, and caused an explosion, provided the dust contained a sufficient amount of gas ; (*d*) gas coal, containing from 24 to 32 per cent. of

volatile matter, yielded a less length of flame; but, which, however, extended as far as the dust, if the dust was sufficiently fine; (e) gas coal, with more than 32 per cent. of volatile matter, causes elongations of the flame only 20 metres in length, except in the use of artificially fine dust, when the flame then extended as far as the dust.

These results consequently refute the opinion that has hitherto been generally held—that only coals containing at least 30 per cent. of volatile matter could furnish inflammable dusts, and that the inflammability was in proportion to the amount of volatile matter. These experiments also prove that a much smaller quantity of dust than Messrs. Galloway, Mallard and Le Châtelier supposed necessary, will cause serious danger. Prior to these experiments being undertaken, it was thought that in order to cause an explosion there must be 1 kilo. of coal dust to a cubic metre of air.

4. In reality, there are but very few coal dusts (those of the Pluto and New Iserlohn mines excepted) which are dangerous of themselves; it is when there is a certain proportion of firedamp present, even 2 to 3 per cent., that the great majority of coaldust become imminently dangerous.

5. Coal dust is not inflamed in an atmosphere free from gas, but if the atmosphere contain from 5 to 6 per cent. of firedamp, combustion takes place.

6. The action of violent explosives on coal dusts and firedamp is much less than that of ordinary gunpowder.

7. Coal dust may be fired when blasting the mine, as well as by an explosion of firedamp.

8. In damping coal dust, the danger of inflammation is not entirely removed unless the latter is damped by a weight of water equal to about half its own weight. These results have been confirmed most evidently by the experiments made at Chatham in 1882 and 1883 by the English Commission on Accidents in Mines, also by the results obtained quite recently (1885) by the Mines Department of Saxony in the experiments made at the Brückenberg shaft, No. 1 (Zwickau), where about 100 sorts of coal dust were experimented upon.

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Annual General Meeting of Bell's Asbestos Company, (Ltd).

The third ordinary general meeting of Bell's Asbestos Company, Limited, was held on February 24, at the Cannon Street Hotel, London, E.C., Mr. John Bell (the chairman of the company) presiding.

The SECRETARY (Mr. R. Lauder McLaren), read the notice convening the meeting; the report and accounts were taken as read.

The CHAIRMAN said: Gentlemen, I will just make a few observations upon the leading items in the accounts. The bills receivable are stated at £10,273 as on December 31, since which about three-fourths of them have fallen due, and, as a matter of course, have been paid. I say as a matter of course, because they would not be kept in their position in the accounts next to the cash—they would not be allowed by the auditors to be so kept—if there had been any doubt with regard to them. All of you who have any experience of the auditing of Messrs. Cooper Brothers & Co. know perfectly well that all such things as allowance for bad and doubtful debts, writing off for plant or stock, and so forth, are always strictly and severely attended to. A very full allowance has been made for bad and doubtful debts, and, therefore, the £31,723 that you see there is as good as the bills to which I have just referred. The stock has grown during the last year, from two causes: We made some purchases in advance of our requirements, which we considered of a very advantageous nature for the company, and the decline in the trade mentioned in the report has caused an accumulation of stock; but everything that may be called old and obsolete—and we have very little—has been put down at nil. You may take it that the general principle is that the stock is valued simply at cost price. I never saw a safer figure in the assets of any company than this £51,599 in the balance-sheet placed before you to-day. With reference to buildings, plant and machinery, fixtures, and so forth, you will recollect that when this business was taken over by the company it was stipulated that the plant and machinery were purchased at the price at which they stood in the books of John Bell & Son, subject to an independent valuation, and an independent valuer estimated them at double the amount, or thereabouts, at which they were taken over by the company. (Hear, hear.) That was due to the severe writing down which had taken place for several years previously, and that same severity in writing down has been continued since the formation of the company, and, therefore, that item of £6,837 may be taken as a very good asset. (Hear, hear.) The asbestos estates in Canada were purchased by the company from John Bell & Son at the exact price at which the firm had acquired them, and that fact, as it was a magnificent purchase by the company, was part of the consideration for the good-will paid for that firm. The mines at the present day are worth vastly more than the sum paid for them and the total goodwill put together. (Hear, hear.)

I have never considered it my duty to enter into newspaper discussions about the affairs of this company; I have always considered it to be the reverse of my duty. Therefore, I have not replied to various criticisms made at different times, but have been rather inclined to let calumny die out. But in deference to the wishes of many of our best friends, and especially of many of our best customers, I have something to say to-day, and some very plain things in the way of pointing to what lies at the bottom of the decline in our trade during last year. (Hear, hear.) A year ago it was my duty to lay before you the system on which we follow the very common practice of giving gratuities to those who have the practical handling of the goods we sell. I told you, in words which could not be honestly misunderstood, that we had never given a penny to any man to cover inferior quality or shortness of weight or measurement; that in no sense or degree had we ever corrupted any man by a bribe or inducement to do wrong. (Hear, hear.) You gave your sanction to our action in this matter, and very soon after the First Lord of the Admiralty stated in the House of Commons, in reply to a question, that the name of our company had, on this account, been removed from the list of contractors to the Admiralty. If we had been asked whether we had anything to say for ourselves, we should have been able to reply that during our ten years' dealing with the Admiralty we had never given a penny to any servant of the department, that no mark stood against us for failure of our material under any circumstances, and that we had never been wanting as to weight or measurement to the extent of a single gramme or millimètre. (Hear, hear.) We could have added that the most important forms in which asbestos is used in the navy had been first designed and worked out to practical use by us, at great cost of time, labour, and money. No such question, however, was put to us, and, as was not unnatural, the belief became general in the public mind that such a denunciation in the most public place in the world, in language of marked severity, by a person of high position and responsibility, was the result of an official investigation by means of which we had been convicted of corrupting public servants. It suited and still suits the purpose of previously very unsuccessful trade rivals to propagate and foment, by many devices, the impression that we are not as honourable traders as they. A certain section of the so-called financial press had been useful allies of our trade rivals in furnishing specially dished-up articles and paragraphs which zealous commercial travellers have brought under notice in thousands of places where, but for their efforts, such papers would never have been heard of. Set going by so powerful an authority as the First Lord of the Admiralty, the campaign against us became fashionable, and gained strength as it proceeded. The sowing of wicked calumny broadcast became easy of accomplishment, and has been fortunate in achieving such success as all efforts on the part of its chief promoters to rival us in the excellence of our manufactures and in the success of our trade had utterly failed to attain. We have to own that what fair competition could not do, persistent detraction in private and in public has accomplished, the result being that during the past year we have lost a large amount of trade. I shall endeavour to show you, not by dry reasoning on abstract principles, but by an appeal to your own every day experience, that to point to this company as something out of the common, and to make up against it a charge of bribery and corruption, is outrageously unjust, and I hope to leave on your minds a conviction that having stood so well as we have stood, the heat of the first onslaught, we shall eventually come out of this contest chastened, but not vanquished, and that we shall regain our former hold of the first position in our trade, which, though it has been shaken by the events of the past year, no one has yet been able to wrest from us. (Cheers.) Thus, I shall hope to justify the belief expressed in the report, that the decline in our trade will not be permanent. (Cheers.)

I have declared to you, but let me, by repetition, emphasise the declaration, that we have never given a penny to any man to cover defect of quality, or short weight or measurement. No man has ever ventured to say that we have, though there are those who would give much to be able to say so. True, we bow to the rule of "backsheesh," as it is allowed to prevail in all countries, and among all sorts and conditions of men. It is not enough to say none are too low for it; we must also say none are raised above it. Bribery and corruption are not so allowed to prevail; the humblest despise them as sincerely as the highest. But gratuity giving in an infinite variety of forms, though nowhere commended, is everywhere practised without reproach to him who gives or to him who receives. (Cheers.) Take an instance or two. A railway porter secures for you, to the exclusion of someone else, a comfortable corner seat and gets sixpence; but the man opposite to you has given somebody half-a-crown so that he may travel first-class at third-class fare. You have given an unlawful gratuity, which cannot be defended on abstract principle; but nobody accuses you of bribery and corruption, as they rightly do the fellow opposite you. The good sportsman, respected merchant, esteemed director of the great railway and steamship companies—even a noble lord (if he be not one of the Admiralty)—when he sells a horse gives a sovereign—sometimes more—to the groom of the buyer. Why does he give this unlawful gratuity if he honestly believes the animal to be all that he has described him to be? Why, he follows a custom, and he feels himself safer in doing so than he would if he kept the money in his own pocket. Who dreams of accusing him of bribery and corruption? In the shooting season the moors of Scotland are crowded with directors, managers, superintendents, and all sorts of people who can influence or give out orders. They are not on the moors at their own expense. Luxurious yachts career over the seas filled with such men, also not at their own expense. Here is a vast use of what, strictly speaking, is undue influence to gain a trade object. But who calls it bribery and corruption? Who ever proposes to strike his host's name from a list of contractors because of it? Yet, if I give a weekly-wage earning mechanic a couple of sovereigns to help him to afford his family a summer holiday at Blackpool or Margate, up go your eyes and out comes the Pecksniffian howl—(laughter)—against bribery and corruption. Your solicitor—I know my friend Mr. Stibbard has always been one of the exceptions which prove the rule—gets a commission when he influences you to insure your life or property in a particular office. Some bankers get a return of brokerage when they employ a stockbroker to invest your funds. Some great railway companies tip forwarding clerks to secure a preference of goods traffic for their lines. Makers of steam engines propitiate the man who is to drive a new engine just laid down. Even these remarks of mine will, in certain places, be favorably commented on, or the reverse, according as we are liberal or otherwise in purchasing copies of certain journals for distribution. (Laughter.) One more example in a region where one treads with reverential care—the region of high justice. When commercial companies go into liquidation, it often happens that an eminent public accountant is appointed by the court to carry on the business, and such official manager finds that he has to fall in with this practice of gratuity-giving, or the business would come to a deadlock. He applies for and obtains the sanction of a judge. This, of course, could not be if all gratuity-giving for the furtherance of business was bribery and corruption. (Hear, hear.)

I might occupy much more of your time in pointing out scores of facts in your own everyday experience, showing "backsheesh," which is universally admitted to differ from bribery and corruption, is used throughout all grades of society to further the ends men have in view. But why dwell on what is in every man's conscience? My point is not that gratuity-giving is right, but that Bell's Asbestos Company is not different to other men, that we are in the common swim, and that this fact must come to be acknowledged as a fact; and thus men will see that we are more sinned against than sinning, and that as the public judgment in regard to us regains it balance we shall recover the trade which has been, without due cause, withdrawn from us. Some of you shareholders in this company are employers of labor, and are users of steam power. If you wish to do away with this system of gratuity-giving, you must do something more effectual to the purpose than transferring your account from us to one of the opposition concerns. You must go below the surface, and recognise that this matter has its root in the never-ending struggle between capital and labour; that it is an outcome of the determination of every man to use any power he possesses to get something beyond the bare necessaries of life; and if you don't like the form of it, set yourselves to provide a substitute for it. It is that substitute which the directors of this company are anxious to find, and we are ready to co-operate with any set of employers who will honestly deal with this question on the human, not the Pharisaic principle. Now, gentlemen, shareholders in this company, do your part. Let no man in your presence venture to accuse this company of bribery and corruption; tear the mask away wherever you meet it, and assert your company as better able to look the world in the face than any of its traducers. (Applause.) Do this boldly and constantly, and you will soon have your dividends over 20 per cent. again. Let us now pass on to the Canadian properties of the company. The use of asbestos in the manufacture of steam packing and as a non-conductor in various forms has greatly grown, and the consumption has completely caught up the supply obtainable from such mines as are in efficient working at Thetford and some less important outside places, but no new application of the material calling for large quantities of it has come to light. For the present trade the mines now in work can furnish what is required, and the remunerative prices which have now become established will sufficiently stimulate production at these mines to meet the growing demand until some new use of asbestos calls for larger quantities than can be supplied from the present sources. We have not abandoned, as certain busybodies have alleged, our Bellmina and Hayden estates. We have them in reserve, and when the growth of our trade requires us to break into new ground, your directors will not hesitate to do the work. Meanwhile we shall be content to make money quietly and safely at Thetford. We have made very important forward sales of the estimated surplus of crude asbestos over our own manufacturing requirements during the present year. I am under engagement to the buyers not to mention quantities or prices, but I may venture so far as to state that these sales will, with ordinary good fortune in the working, give us a very much larger profit than has ever previously been obtained from ours or any asbestos mines. It is true the effect of these sales will be somewhat watered by previous contracts at much lower prices, the fulfilment of which to some extent runs into the present year. It is also probable that the fact of there being a quantity deliverable by us at comparatively low prices has militated against our obtaining so high a value as we should otherwise have secured. I am, however, very sure that our policy of dealing freely at the prices obtainable in the natural course of our trade is the right policy, and we have done so well in these present contracts that regret is out of place. The income now being derived from the Thetford Mine places the value of that estate at a higher sum than was paid by the company for all the properties and goodwill of the business taken over. We are very desirous of strengthening the board by the addition of a member possessing the necessary experience and influence to make him a real acquisition to the company. We want a man whose knowledge, experience, and influence count for something among steam users, and a man who will be satisfactory to our altered list of shareholders. We are in very full communication with a gentleman of first-rate commercial standing, and of the sort I have just described, and I hope that we shall soon be able to make an announcement on this subject which cannot fail to be satisfactory to the shareholders. In this matter the directors have given special attention to the change which has taken place in our list of shareholders. Our shares have now passed out of the few hands in which they were held in large blocks, and, instead of a trifle over 300 shareholders to whom we allotted, we have now about 900 members. This altered condition of our share list may, and probably will, bring about important changes. One beneficial change that we look for is that, as small shareholders take more direct interest in their investments than great ones, therefore, the spread of your stock into many hands will strengthen the company in many ways and advance its trade. I now move: "That the report of the board of directors and the auditors, and the financial statement, submitted to the meeting, be, and the same are hereby, approved, adopted and confirmed. (Cheers).

Mr. T. B. Lightfoot seconded the resolution.

Mr. Atkinson asked a series of questions, which he had had printed and circulated amongst shareholders at the meeting.

Mr. Louis Hirsch asked if Mr. Atkinson was a shareholder in the company.

Mr. Atkinson.—I have a receipt for my transfer in my hand.

Mr. Hirsch.—How many shares?

Mr. Atkinson.—I have been sent by gentlemen who have lost a lot of money over this company. (Cries of "How many shares?") I hold one share. (Laughter, and cries of "Sit down!") That was presented to me —(laughter)—by gentlemen who have lost hundreds of pounds by the shameful rigging of asbestos.

Mr. Hirsch.—I have just been informed that Mr. Atkinson is not a registered shareholder, therefore he has no right at this meeting at all; certainly no right to speak. (Hear, hear.) I think it is a presumption.

Mr. Atkinson.—I do not want to say any more.

Mr. Hirsch.—You have said quite enough. I should propose, Mr. Chairman, that you do not answer those impertinent questions. No registered shareholder desires them to be answered.

The Chairman.—I could not possibly answer a person who is not a shareholder.

Mr. Hirsch.—I should propose that the person be requested to remove himself, or else we shall have the unpleasant duty of removing him. ("Hear, hear," and laughter.) It must be patent to every shareholder that persons who ask questions like this have not the interest of the company at heart. (Hear, hear.)

Mr. Ridley here rose and said he would put the same questions to the chairman.

Mr. Hirsch hoped the chairman would take the sense of the meeting before he answered them.

The Chairman.—There is no difficulty in answering them, as a shareholder has put them. The Chairman then dealt with the questions seriatim, as follows:—"Is it true that there is an action pending against Bell's Asbestos Company, instituted by Messrs. Ward and King, either jointly or severally, or any other Canadian mine owner, for damages for encroachments upon asbestos property?" There is no action whatever against the company by any firm of persons named Ward and King. We have had to enter an action against Mr. Ward to remove him from a portion of our property. It is a boundary dispute. Some people named Johnson, who think we are trespassing on their property, commenced an action against us. These are very minor matters—the claim against us is in respect of 9 ft. of land. (Laughter.) We claim from Mr. Ward 22 ft. of land. We are advised that we are sure to win. "Is it true that there is an action pending against Bell's Asbestos Company brought by a firm in Aberdeen for damages for alleged defective machinery or plant supplied or fitted or other causes?" It is not true; nor has anyone else in Scotland commenced an action against us. "Is it true that about 150 tons of crude asbestos, which has been valued at about £40 a ton, has to be delivered at about £20 a ton?" No; not a word of truth in it. "Is it true that about 350 tons of crude asbestos has to be mined and delivered for about £20 a ton this year?" Yes; we have more than 350 tons to deliver at £20, and a very profitable price it is, too. (Hear, hear.) "Has there been any loss during the year ending December 31, 1890, on businesses at London and branches? and, if so, how much?" No; there has been a profit. "Will it be necessary to spend any money on the Canadian mines this year? and, if so, how much?" Of course it will; we spend money every year upon them, and cannot get the stuff out without. (Laughter.) "How much is expected to be spent on new buildings in London or elsewhere this year?" About £15,000. "Is there any special reason why the goodwill, patents, etc., should be valued at £69,101 18s. 8d., the same amount as inserted in the first year's balance-sheet, when it is stated by the board that the home business is declining?" The reason is simply this, not to go into any question of goodwill on the general business, which, everybody must admit, is worth something: the position we occupy is that we have estates in Canada worth more than was paid for all the estates and properties and goodwill put together. (Applause.) "Is the system of 'tipping' still continued by the consent of the board?" I decline to go into any question of the internal management of the company with anybody. (Hear, hear.) "Is the Mr. Sheredan who sent such glowing reports respecting the Harnhalli Gold Mine related to the Mr. Sheredan who is manager of Bell's Asbestos mines in Canada?" I do not believe there is any relationship between the two Mr. Sheredans referred to; I have never heard of it.

Mr. Atkinson was about to speak again; but

Mr. Hirsch rose to order, and told him he ought to be grateful to the meeting for allowing him to be there at all. (Laughter.)

The resolution was then put, and carried with one dissentient—Mr. Ridley.

The Chairman moved the declaration of a dividend of 5s. a share, free of income tax, making a total distribution, with the interim dividend, of 15 per cent. for the year.

Captain A. J. Burnett seconded the motion, which was agreed to.

The retiring director, Mr. T. B. Lightfoot, was re-elected on the motion of Captain Burnett.

The auditors, Messrs. Cooper Brothers & Co., were re-appointed on the motion of Mr. Bird, seconded by Mr. Long.

The proceedings then closed with a vote of thanks to the chairman.

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A New Process for Gold Extraction.

A new process for extracting gold from pyrites has been brought out in South Australia, and patented in other parts of the world. It consists in calcining the crushed pyrites in a furnace at a low degree of heat, operations being expedited by introducing a jet of gas containing an excess of oxygen, into a hollow cylinder, in which the ore is being roasted. The cylinder is made to revolve in the centre of the furnace, at a slight inclination from the horizontal, so that as it turns slowly round, the pulverised ore finds its way gradually from the upper to the lower end. Within the cylinder are a number of small flanges for the purpose of raising and carrying round the ore, which, by this means, drops clear from the top to the bottom of the cylinder, and is thus exposed to the full force of the jet of gas before mentioned. The ore is fed into the cylinder through a hopper, and the lower end is left open. On the crown of the furnace is an iron retort, which is charged with crude nitrate of soda wetted with acid. Nitrate and hydrochloric acid are obtained, and sulphuric acid from the sulphur contained in the pyrites. These products are derived from the gases which are stored in a chamber constructed for the purpose. The retort has a curved pipe descending into the open end of the cylinder, so that the jet of gas plays full into it. In the working model made by Messrs. May Brothers, engineers, of Gawler, the cylinder was 5 feet in length, and the time occupied by the ore in passing through it, under 12 minutes, by which time the calcination was complete, and the pyrites decomposed. The ore could then be at once amalgamated with mercury, but the present plan is to transfer it at once into a bath of *aqua regia* composed of the acids before mentioned. By allowing it to remain in this bath for from 15 to 30 minutes, the gold is dissolved, and the liquor is next filtered through charcoal which retains the gold, and the charcoal being placed in a furnace the metal is smelted and recovered.

It is claimed that the process will save 95 per cent. of the gold contained in the pyrites, and that the cost of the operation will not exceed 4s. per ton of pulverised ore, which cost includes interest on the plant required. The cost of a plant capable of treating 100 tons per week, is estimated roughly at between £300 and £400. Hitherto, by most of the ordinary processes, it has been difficult to save more than 50 or 60 per cent. of the gold in pyrites, so that if the patent saves even 90 per cent. it is a vast improvement upon the methods commonly in use. Not only is its advantage seen in saving 15 dwts. where only 10 was got before, but in the lower cost of the process, so that 1 dwt. of gold would about cover the cost of saving 15 dwts., whereas 2 would be required to recover the 10 dwts. The inventor claims, as part of his patent, the right to use any peroxide in treating ores, and to apply the process to other metals besides gold. He is about to experiment on the zinc ores, which abound in the silver mines at and around Broken Hill, and is sanguine of being able to separate the zinc, which, though valuable, is mostly lost at present. He considers that the same principle is applicable also to the treatment of copper pyrites.

The working model above referred to is capable of treating about 30 cwts. of ore per diem, and the experiments have been thoroughly successful. In fact, the inventor and his friends satisfied themselves by repeated experiments of the effective nature of the invention before they went to the expense of patenting it in nearly all the important gold producing countries of the world. It is intended now to erect works in Adelaide on a large scale, so that pyrites can be treated in quantity. Amongst other advantages possessed by this process are (*a*) the saving in grinding the stone, as screens of 100 holes to the square inch are quite fine enough, the desulphurising process effecting all that is required on that grade; (*b*) in treating sulphide ores an excess of liquor is produced, and is available for the treatment of other stone containing very fine or "flour" gold, which can by this means be readily saved; (*c*) the entire removal of the sulphur is not necessary so long as the pyrites is decomposed; and (*d*) it is impossible to slag the ore as it must come out perfectly oxidised.

MINING NOTES.

Quebec.

The output from the Phosphate of Lime Company's mine at High Rock during February was 580 tons. A force of 175 men was employed. Mr. Walter Pickford, the superintendent, has returned from his visit to Florida.

Mr. James Cooper, president of the Ingersoll Rock Drill Company, and Mr. George R. Smith, have returned from England, having succeeded in forming a company to operate the Pearson property in the Templeton District. Details of this company will be found in our company column.

We would also direct our readers' attention to the formation of the first English company to operate the asbestos deposits of the Ottawa Valley, under the title of the Templeton Asbestos Mining Company.

The output from the New Rockland Slate Quarry, at New Rockland, for February, was somewhat less than last year. About 150 men are now employed, but this force will be doubled in a week or two. It is understood that several important additions to the plant will also be made.

Mr. Mercier having gone to Europe without giving any attention to the request of the General Mining Association for the repeal or amendment of his obnoxious bill, a meeting of the Council of the Association has been called for the 1st prox., to consider the advisability of having the bill vetoed in the coming session of Parliament.

Ontario.

Mr. Francis L. Sperry, who has been with the Canadian Copper Company since they began operations in the Sudbury nickel field in 1886, has resigned his position of chemist, and is now located in Sudbury. He will devote himself hereafter to advancing the mineral development of the Sudbury region.

Manitoba and North-West Territories.

The Lethbridge Coal Co's pay sheets for last month for the mines include 588 names, and for the railway and workshops 398, making a total of 986 employes. The total amount paid out in wages alone was over $50,000. Several of the miners drew over $100 for the month, two going as high as $117 each. Besides the above the company's bills to the merchants of the town for supplies amount to about $15,000.

British Columbia.

Cariboo District.

The Waverley Hydraulic Company of Grouse Creek, have not as yet reached bed rock with their cut, but their wash-ups improve as they get nearer the bottom of the channel.

The Forest Rose, Taylor and Black Jack Companies, on Williams Creek, have paid fairly well last year.

In his annual report to the Minister of Mines, Mr. John Bowron, G.C., writes: "The opinion has prevailed for many years among our most experienced miners from California and Australia that, judging from the formation of the country, there existed, and ultimately would be found in this district, immense obliterated river channels traversing the country upon a higher level than the present streams, which in crossing the former, in many instances, received therefrom their chief supply of the precious metal. The first of such ancient river channels would now appear to have been discovered on the south side of the South Fork of the Quesnelle River. A Chinese company working up Dancing Bill's Creek, three miles above the Forks (*vide* Mr. Bowman's map), when about a thousand feet from the Quesnelle River, and at an altitude of one hundred and twenty-five feet above the stream, came to a pitch off in the bed rock which they were unable to follow, owing to the quantity of water encountered. They continued working ahead as near on a

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level as the grade to the sluices would allow. This occurred some ten or twelve years ago, and they have continued since that time to work into the hill without finding bed rock. They use hydraulic pressure in working; but as their water supply is limited, and the face of their cut is now nearly two hundred feet in height, they make but small headway, but are known to have been taking out, with six men working, from five to eight thousand dollars annually. The operations of this company having for some years been watched with interest by the white miners in the vicinity, and the developments seeming to confirm their pre-conceived ideas of an immense 'blind' river channel in the hill, Messrs. Barker, Polley, Burrill & Co. sank two shafts half a mile above the Chinese Company, and back some fifteen hundred feet from the river, behind the rim rock which forms the river bank, and although not reaching bed rock, owing to the quantity of water encountered, they found similar prospects to those obtained in the Chinese claim. Subsequently, Mr. John Hepburn, of Victoria, located ground below the Chinese, and in running in cuts developed similar pay gravel inside the rim rock, which is regarded as settling the question of a paying channel in the hill beyond a doubt. Messrs. Whittier & Pomeroy below, and the Champion Company above, have also located ground until there are nearly six miles of the channel claimed. Some are of the opinion that the channel will ultimately be traced to the Horsefly River, some twenty miles distant. However that may be, it is generally conceded that there must be at least ten miles of the old river bed. As to the richness of the pay, and consequent importance of the discovery, I can only say it is estimated that the Chinese Company are taking out at least one thousand dollars per lineal foot of the channel so far as they have worked, and as large river channels are usually very regular in the gold deposits, further comments are unnecessary."

Mr. Bowron's estimate of the gold yield from alluvial diggings in this district, is as follows:—

Barkerville Division, to the 15th Nov..	$ 61,200
Lightning Creek Division, " ..	38,000
Quesnellemouth, " ..	26,250
Keithley Creek, " ..	62,000
Probable product from 15th November to 31st December, say..........	8,000
	$195,450

The destruction by fire of the Government Reduction works, last winter, had a depressing effect upon the quartz industry, but now that these have been rebuilt and in operation again, the indications point to increased energy in this promising field.

The Black Jack Quartz Mining Co. have during the season prosecuted work on their mine; their shaft being now down to a depth of something over 100 feet, and exposing a valuable body of ore. Their small prospecting mill was kept running a good part of the time until stopped by frost. This company has taken another lot of sulphurets to the test works, which is now under treatment. A most satisfactory test of the ore from this mine was made at "The Cassell Gold Extracting Co's Works," Glasgow, Scotland. From 360 pounds of ore sent a result of something over $80 per ton was obtained; the ore worked up to 90% of the assay value. The advantages of this company's method is that no roasting is required, and the company claim that in ordinary cases ore can be treated for one-fourth the cost of working by the chlorinating process, a circumstance which, if substantiated by further working tests, means wealth to this district.

The Island Mountain Co. completed their ten-stamp mill, to which are attached four concentrators and an improved rock crusher, and the machinery was put into operation about 20th August, and was found to work satisfactorily. Rock crushing commenced on 25th August, and by 25th September several hundreds of tons were put through. Some difficulty was experienced in getting the silver plates to catch the gold, owing to the presence of some foreign substance coating the plates, but after a time this was partially remedied. Some fifteen or twenty tons of sulphurets were saved and brought to the government works for treatment.

West Kootenay.

On McCulloch Creek the Last Chance Company's tunnel is in 1,150 feet, without any sight of bed rock. The supposition was entertained that the bottom of the channel would be reached in 600 feet, but this has proved a mistake.

The Ophir Bed Rock Flume Co. has put in the necessary amount of fluming to comply with the conditions of their lease. No ground has been worked in consequence of litigation between some of the shareholders.

Lund & Co., at the mouth of Smith's Creek, procured very good returns towards the latter part of the season. A new ditch will be constructed to obtain 300 feet of pressure, and iron piping and a monitor nozzle are to be forwarded by boat early in the spring. The pay has been definitely determined in the deepest portions of the channel, which is about 500 feet wide.

Gold Commissioner Tunstall, writing of the Lardeau River country, says: "On the 4th of August a party consisting of Peter Walker, Lochrie McDonald, Tom Downes and Charles Holden, purchased an outfit at Revelstoke and started in a small boat down the river. They proceeded to the head of Upper Arrow Lake and went up the East Arm, where the boat was left, and a trail cut to Trout Lake. They returned on the 20th November, and reported having prospected a creek which pursues a southerly course and flows into the lake at its head. Holes were sunk in a bench at the side of the canyon, about two miles above, and coarse gold found on the bed rock, but not in sufficient quantities to prove remunerative. Below the canyon the water prevented their attempts to bottom the channel. The prospects obtained indicated that a heavy run of gold exists somewhere in the vicinity. It is their intention to return early in the spring and resume operations.

Under the able superintendence of Mr. Jas. Brady, C.E., the tunnel in the Lanark is now over 500 feet long, 300 feet of which was completed this season. The lode in this claim is from 2½ to 5 feet wide, and of a high grade character. Sixteen car loads, shipped some three or four years ago, returned in silver alone 89 oz. to the ton. The company has expended a large amount of money in developing its property, and is deserving of the utmost success.

The Maple Leaf has two shafts sunk, one at the upper end of the claim 35 feet deep, the other at the lower extremity 45 feet. The vein is 4½ feet wide. Returns from a recent shipment gave a yield of 90 oz. in silver, $\frac{175}{1000}$ oz. gold, and 28% lead.

The Cariboo Company has, during the year, extended its tunnel 100 feet further. The vein is galena lying between walls of porphyry, and varies from 6 to 12 feet in width.

In concluding his report Mr. Tunstall observes: "It is a matter of surprise to every one that the Illecillewaet sub-division has not attracted more attention from capitalists and mining men in general. Many of the veins are rich and well defined, exhibiting large bodies of ore, and possessing the great advantage of being situated within easy reach of a railway, and, in some instances, quite close to this means of transportation. It is, therefore, not owing to the absence of any of these features that development has not been more actively prosecuted, but to the fact that here and elsewhere the majority of mine owners cannot afford the heavy expenditure required for that purpose, and they demand too high a price for their property to secure the investment of capital. Some of the richest mining sections in the adjoining States have experienced similar periods of depression, ascribed to the same cause, until the capitalist was offered sufficient inducements to come to their rescue. It is evident that a more liberal course will have to be pursued to attain the benefit of the great wealth lying dormant by this means in the principal mining districts of the Province."

The celebrated Hall Mines, comprising the Silver King, Kootenay, Bonanza, and American Flag, are situated on the summit of Toad Mountain. They would have employed a large number of men last summer had it not been for the litigation in which they were involved. The tunnel in the Silver King is 330 feet long, in which are employed fourteen men. A large amount of ore is on the dump awaiting the completion of the waggon road for shipment. One hundred and ten (110) tons of ore were forwarded last fall from this mine to Helena, Montana. It was taken from a cross-cut at the bottom of the incline, and sampled from $404 to $414 to the ton in silver and copper.

In consequence of mine owners withholding shipments for the completion of the Columbia and Kootenay Railway, but 205 tons of ore were exported for smelting purposes, of which 110 tons from the Silver King, Toad Mountain sub-division, sampled an average of $409 to the ton in silver and copper, representing a value of $44,990. The respective amounts of silver and copper were not ascertained; and ninety-five tons from the Skyline, Hot Springs sub-division, yielded 280 ounces in silver to the ton, which, at the present value of that metal in New York—$1.09 per ounce—is equivalent to $28,994, making an aggregate of $73,984. The estimated yield of gold from quartz and placer mines is $35,000, the Big Bend returning less than one half its usual output this year.

The number of records effected at the various offices is as follows: Revelstoke, 203; Nelson, 665; Ainsworth, or Hot Springs, 700; Trail Creek, 65; during a period of ten weeks.

"Everything," says Mr. Tunstall, "points to a season of unusual activity this year. The mineral areas are steadily increasing in number and extent by the new discoveries made from time to time. With the increase of ore production other industries will spring into existence, and a large and prosperous population be sustained. The completion of the Columbia and Kootenay railway will be effected in the spring; and measures are now being taken for the erection of an ore shed, and construction of a wharf 600 feet long to deep water. The Columbia and Kootenay Steam Navigation Company are building a new steamer in the vicinity of Nelson, to ply on the lake, possessing a capacity of 135 tons, which, with barges and the addition of the present fleet, will be able to accommodate the increased demand for freight. It is also stated the Hendryx Company will build and equip a steel steamer to run between Nelson and Bonner's Ferry, stopping at way ports.

East Kootenay.

The Monarch mine, situated on Mount Stephen, near the summit of the Rockies, a quarter of a mile from and at an elevation of 850 feet above the Canadian Pacific track, is at present the only fully equipped working mine in the district. The company has resumed work this fall. A force of ten miners is now at work, terms having been arranged to supply the Revelstoke Smelter Company with 200 tons of ore per month. The shipping ore averages about 60 per cent. lead with 10 of silver to the ton. The ore occurs in somewhat irregular chambers, pockets and other deposits in the limestone, with but little gangue, and seems abundant. It is expected that the mineral will lie in more regular form and even greater body when more depth into the mountain has been reached. The mine was discovered in 1884. About 1,500 tons of ore have been extracted and shipped up to the present time. The underground workings amount in the aggregate to about 450 feet of tunnelling, with larger chambers opened out in places where ore was more abundant. A considerable amount of work has also been executed on the outside, consisting of a tramway, galleried out of the face of the mountain, leading to the principal ore bins, and a gravity road from thence to the bins on the railroad, together with all the necessary plant for working the mine.

Lillooet.

The total yield from the Lillooet district for last year is reported, by Mr. Soues, at $71,455; an increase of $11,000 as compared with 1889.

The Lillooet Hydraulic Mining Company, located near the Fraser River Bridge, have been working all the season day and night, most of the time with good success. This same company have just diverted the south fork of Bridge River for over half a mile, and will commence to mine the old channel in the early spring with a strong force of men, using three parallel lines of sluices. They sank two prospect holes and found good indications; from one they took out $24.75 in coarse gold. This company is deserving of every success, as they have spent over $13,000 in opening the two claims.

The Vancouver Enterprise Company have their tunnel in 270 feet, over half-way, which will be completed in the spring, as the company propose keeping steadily at work during the winter. This tunnel will enable them to work their leased ground on Cayoosh Creek to bed rock, and as the Chinese miners, who were discoverers of the gold in this creek, took fully $160,000 from the surface workings, it is reasonable to suppose that the company will find it proportionately rich near to and on bed rock. The Deadwood mine, owned by Messrs. Whittier & Co., has been worked night and day most of the season with good profit.

Under the Mineral Amendment Act, 1890, five leases for hydraulic mining have been granted during the year. On three of these active work has been done. On the other two, which are located on the east side of Fraser River, opposite to the town of Lillooet, it is proposed to bring in water from Cayoosh Creek, which will necessitate a very large outlay of capital. On the leased ground on St. Mary's Creek, and on that of Fraser River Cable Company, there has not been any work done during the past season. Both of these claims are practically abandoned. Very little has been done in alluvial mining on Cayoosh Creek, Bridge River, and tributaries during the season.

Vancouver Island.

Mr. Archibald Dick, Chief Inspector of Mines for the province, officially reports the total coal yield for 1890 at 678,140 tons, produced as follows:—

	Tons.
Nanaimo Colliery..................	389,505
Wellington	174,496
East Wellington....................	44,602
Union	69,537
	678,140
Coal on hand 1st Jan., 1890	20,508
	698,648

The exports were as follows:—

	Tons.
Nanaimo	292,809
Wellington	106,281
East Wellington	35,132
Union	74,048
Total exports	508,270

In addition, the Canadian Anthracite and Coal Co., at Banff, sent via Vancouver, 2,300 tons.

The colliery returns show a home consumption of 177,075 as compared with 124,574 tons in 1889.

The progress of the industry may be judged from Mr. Dick's summary as follows —

	Output.	Export.
1887	413,360	334,839
1888	489,300	365,714
1889	579,830	443,675
1890	678,141	508,270

In concluding an excellent review, Mr. Dick says: "While all the mines are being worked with vigor and unprecedented energy, and with an immense investment of capital, for which there is the best prospect of a safe and profitable return to the lucky proprietors, I sincerely trust that the unhappy differences which have existed lately in this district will be adjusted, and harmonious relations be restored between differing employers and employed, as such a consummation would tend greatly to advance the coal industry and the prosperity of the community, as well as to place this province in a proud position as commanding the market of the Pacific slope, whether as to quality, quantity or price of the great staple article of necessary utility—coal. The outlook for the year we have now entered upon (1891), is the most promising that it has been my good fortune to experience for the coal industry; the harbors of the port of Nanaimo are replete with shipping of every possible size, from the largest ocean ships and steam vessels to the small towing craft and capacious barges, and the powers of the collieries have been strained to the utmost to fill orders to the many comers. I need hardly say that the city of Nanaimo has been a large participant in this stream of prosperity that has visited the district, and I trust that it may long continue and increase."

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CANADIAN COMPANIES.

Mattawa Mining and Smelting Company.—This company has been organized with a capital of $300,000 to mine in the County of Pontiac, Que.. Head office, 102 Broadway, New York; mine address, Baie des Pères, Pontiac Co., Quebec. The officers are R. W. Chapin, president; W. L. Turner, vice-president; Edmund Coffin, jr., Secretary-Treasurer.

The Moosomin and Souris Railway and Coal Company.—Application will be made to the Dominion Parliament for the incorporation of the above company, with power to construct and operate a railway from a point on the line of the Canadian Pacific Railway Company at or near Moosomin, in the District of Assiniboia, to a point at or near the international boundary, in Township one, Range six, west of the Second Principal Meridian, and to construct and operate telegraph and telephone lines in connection with the said railway and coal company, and with power to buy, lease, acquire, sell and mortgage lands for coal mines, and to work such mines, and to sell the product of such mines, and generally with all powers, rights and privileges usually granted to railway companies under charters of incorporation.

La Compagnie des Mines d'or de Mattawa.—Notice is given that the above company has been incorporated under the laws of the Province of Quebec, to prospect and work gold, silver and other minerals in the said province. Head office, Joliette. Capital stock $24,000, in 2,400 shares of $10 each. Those incorporated are: E. Guilbault, A. Magnan, J. Rivard, J. H. Renaud, J. H. Ostigny, D. D'esormiers, all of Joliette, and J. Alderic Ouimet, Montreal.

The Templeton Asbestos Mining Company (Ltd.)—This company has been formed in London, Eng., with a capital of £25,390, in 2,500 ordinary shares of £10 each, and 390 founders' shares of £1 each, to acquire asbestos mines, mining rights and land likely to contain asbestos in the Province of Quebec, and to work the same. The number of directors shall not be less than three nor more than seven, and the qualification is £500. The first subscribers, taking five shares each, are:—R. Wissmann, Overhill Road, Dulwich; J. Werner, Richmond, asbestos merchant: C. R. Hammer, East India Avenue, London; E. Schwarte, East India Avenue, London; C. Keening, Creechurch Street, London; H. Meyer, Threadneedle street, London, banker; M. J. Richoff, Throgmorton street, London.

The West Kootenay Mining Co.—This company was registered under the laws of British Columbia, on the 23rd ult., for the purpose of purchasing and owning mines in Canada and the United States; the operating of smelting and reduction works; the buying and selling of bullion and other products, and generally to carry on a mining business in all its branches, with the customary powers. Term of existence, fifty years. Head office, Ainsworth, Kootenay Lake, B. C. Capital stock, $1,000,000 in 100,000 shares of $10.

The New Brunswick Mineral Developing Company.—Application will be made to the New Brunswick Legislature by the above company, for incorporation, to prospect for minerals, deal in mines and mining claims, operate mines and carry on a smelting and refining business. Head office, St. John, N.B. Capital stock, $50,000, in 5,000 shares of $10. Applicants, J. De Wolfe Spurr, G. W. Merritt, H. A. Drury, R. C. Elkin, B. G. Taylor, all of St. John, N.B. The three first named to be the first directors.

Ogema Mining and Smelting Co. of Thunder Bay (Ltd.)—This company, to which reference has before been made, has been incorporated under the Ontario Act.

The Belmont Bessemer Ore Company (Ltd.)—Application will be made to the Ontario Legislature by the above company for incorporation. The objects of the company are the prospecting, acquiring, etc., of mines, mineral and other lands in the Townships of Belmont and Methuen, Peterborough County; the Township of Marmora, Hastings County; and the Sudbury and Fairbank regions in the District of Algoma—more particularly Lot 19, 1st Concession, Township of Belmont; the opening up and working of mines in these districts, the erection and operation of smelting and refining works, and generally, the carrying on of mining in all its branches. Head office, Toronto. Capital stock, $600,000, in 6,000 shares of $100 each. Applicants, J. M. Ashley, jr., vice-president of the Toledo, Ann Harbor and North Mich. Railway, R. L. Major, W. A. Kissam and J. T. Sill, all of New York, and Edmund Bristol, Toronto; all of whom are to be the first directors.

Atlantic Stone Company.—This company is applying for incorporation, under the Nova Scotian Act, for power to open up and work stone quarries, sell the products, and for other customary powers. Head office, Lower Cove, Cumberland County, N. S. Applicants, A. Seaman, R. S. Hibbard and E. Q. Rowan. Solicitors, Townshend, Dickey & Myers, Amherst, N.S.

The MacGregor Lake Phosphate and Mining Company (Ltd.)—This company is applying for incorporation by the Dominion Parliament for the purposes of acquiring and holding mineral and other lands and mining rights, phosphate of lime and other ores, of selling, dealing in and disposing of the same, and of pulverizing and reducing the said minerals and ores, and manufacturing and dealing in the commercial products thereof, throughout Canada and in Great Britain. Head office, Montreal. Capital stock, $60,000 in 600 shares of $100 each. Applicants, Alexander Cross, Glasgow; J. R. Stewart, Glasgow; G. R. Smith, Buckingham, Que.; James Williamson and J. C. Smeaton, Montreal. The last three named to be provisional directors of the company.

The Liverpool Land and Improvement Company (Ltd.)—Application will be made to the British Columbia Legislature for the incorporation of the above company, to purchase, etc., lands, and among other things, to deal in ores of every description, and to make any improvements, etc., on said lands. Head office, New Westminster, B. C. Capital stock, $500,000, in 5,000 shares of $100 each. Applicants, John Hendry, B. Douglas, Henry Elliott, H. Hoy, E. S. Scoullar, all of New Westminster.

Richmond Slate Quarrying and Asbestos Company.—The first annual meeting of the shareholders of this company was held at Richmond on the 24th inst. The following gentlemen were elected directors: Messrs. Thomas Logan, J. C. Bedard, J. U. Messier, L. Jutras and J. N. Jones. Mr. Thomas Logan was elected president; Mr. J. C. Bedard, vice-president and managing director, and Mr. E. J. Bedard, secretary.

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Latest Stock Quotations of Canadian Companies in England.

	Price.	
Excelsior Copper, Limited, £410,738 fully-paid shares of £1	—	
Nicola, Limited, £35,000 fully-paid shares of £1	—	
Shuniah Weachu, Limited, £99,888 fully-paid shares of £1	—	
Silver Wolverine, Limited, £68,465 fully-paid shares of £1	—	
Tilt Cove Copper, Limited, £160,000 fully-paid shares of £2	—	
Ditto, £80,000 5½ per cent. debentures	—	
General Mining, Limited, £219,752 fully-paid shares of £8	3¼	3¾
Low Point, Barrasois and Lingan, £509,100 fully-paid shares of £100	—	
New Vancouver Coal Mining and Land, Limited, £185,000 fully-paid shares of £1	¾	1
North-Western Coal and Navigation, Limited, £160,500 6 per cent. debenture coupons, June 30 and December 31; principal 1904	—	
Ditto, £149,500 fully-paid ordinary shares of £10	—	
Ditto, £900 fully-paid deferred shares of £100	—	
Sydney and Louisburg Coal and Railway, Limited, £50,000 cumulative 10 per cent. first preference shares of £10, £6 paid	7½	8½
Ditto, £14,560 fully-paid non-cumulative 6 per cent. second preference of £10	3	5
Ditto, £250,000 fully-paid ordinary shares of £10	¼	¾
Anglo-Canadian Asbestos, Limited, £11,500 fully-paid shares of £2	—	
Anglo-Canadian Phosphate, Limited, £46,510 fully-paid preference shares of £10	—	
Ditto, £25,000 fully-paid deferred shares of £10	—	
Bell's Asbestos, Limited. £140,000 fully-paid shares of £5	12⅜	12⅝
Ditto, £68,400 debentures, 5 per cent.; interest January 1 and July 1	—	
Canadian Phosphate, Limited, £100,000 fully-paid shares of £1	—	
General Phosphate, Limited, 5 per cent. ordinary shares of £10, £2 paid	—	
Ditto, £5,000 fully-paid founders' shares of £10	—	
Western of Canada Oil, Limited, £200,000 fully-paid shares of £100	—	
Ditto, £99,850 fully-paid shares of £50	—	
Western of Canada Oil, Limited, £199,700 12 per cent. debentures of £100	—	
White's Asbestos, Limited, £20,000 fully-paid shares of £1	—	
Ditto, £15,000 shares of £1, with 15s. paid	—	

Excelsior Copper.—Registered September 26, 1888. Accounts to December 31 submitted in April. No dividend yet. Liquidation and reconstruction have been decided upon.

Nicola.—Accounts to December 30 submitted in November. No dividend yet.

Shuniah Weachu.—Accounts to November 20 submitted in February. No dividend yet. Shares for £12,870 held by the Company.

Silver Wolverine.—Registered October 19, 1888. No report of meeting received yet.

Tilt Cove.—In March, 1890, the properties were leased for 99 years to the Cape Copper Company, Limited, at a rent of £4,400. The Cape Copper Company advance £15,000 at 5 per cent. interest, and when this is repaid out of profits; surplus profits are to be divided equally between the Cape Copper Company and the Tilt Cove Company. The lease may be determined by the Cape Copper Company at any time on twelve months' notice. Accounts annually to March 31 submitted in November.

General Mining.—Accounts to December 31 submitted in April, but an interim meeting is held in November. Dividend for 1884, 5 per cent.; for 1885 and 1886, 3⅛ each year; for 1887, £4 13s. 9d. per cent., and for 1888 and 1889, 3¾. Reserve fund, £29,850.

Low Point.—Accounts to December 31. For 1887, 1888, and 1889, 5 per cent was paid each year on the ordinary shares publicly held; for 1888 the ordinary shares issued to the vendors got 3½ per cent., and for 1889, 2½.

New Vancouver Coal.—Reconstructed in 1889. Accounts to June 30 and December 31 submitted in November and May. For the two half-years to June, 1889, 5 per cent. per annum was paid, and for the two half-years to June, 1890, 4. Debentures, £60,000.

North-Western Coal.—The deferred shares receive no dividend until 15 per cent. per annum (cumulative) has been paid on the ordinary. Accounts to June 30. Dividend for 1887-8 and 1888-9, 5 per cent. per annum.

Sydney and Louisburg Coal.—Accounts to December 31 submitted about May. In respect of 1889 15 per cent. was paid on the first preference, leaving arrears of 50 per cent.

Anglo-Canadian Asbestos.—Reconstructed in 1889. Debentures, £3,450.

Anglo-Canadian Phosphate.—The preference shares rank first for 7 per cent., and after a like rate has been paid on the deferred shares, both classes rank equally. Accounts to November 30, submitted in May. No dividend yet on either class. Debit to profit and loss on November 30, 1889, £4,784. One of the mines has recently been sold and another leased.

Bell's Asbestos.—Accounts to December 31 submitted in January. Dividends for 1888 and 1889, 22½ per cent. each year. Reserve, £5,000. The debentures are redeemable by 1913, by annual drawings at 115 from a sinking fund, which the directors may increase.

Canadian Phosphate.—Accounts to November 30 submitted in February. Eleven months to November 30, 1888, resulted in a profit of £2,576. which was carried forward. A dividend of 6d. per share is to be paid November 1, 1891.

White's Asbestos.—Registered April 9, 1889. Accounts submitted on December 31. Liquidation has been decided on. See meeting of company in this issue.

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New Reduction Works.—The new reduction works at Rat Portage are now ready to commence operations, a number of minor parts of the machinery which were wanting having been made. Between 30 and 40 men will be employed, and the works will be in full blast before navigation opens. Ore from the mines around Port Arthur, now sent to the United States to be crushed, will be operated on, and the management is hopeful that the trade will rapidly increase. The capacity of the works is 80 tons of crude ore every 24 hours, which converted into concentrates would represent 800 tons daily, which would be the maximum output. This new industry will afford a living to about 5,000 souls in treating the ore, from its bed in the mines until after it passes through the reduction process.

Duties of Miners.—The statute books are full of mining laws, pushed through the legislatures of the coal or ore-producing States of the Union by political demagogues who have no conception of the subject which they champion, but who, for the sake of votes and political preferment, would use all their energies, if necessary, to secure the appointment of goats as guardians over asparagus beds. The majority of these mining laws dictate what the operator must do, but very little is to be found as to the duties of the miner—simply jug-handle enactments. What is the use of mining laws, called into existence by and through the influence of men who call themselves the representatives of miners, laws calculated to benefit them, the miners, if they pay no heed to the strict compliance therewith, as regards their personal safety? Many excellent regulations are laid down for the good government of mines, with a view to protect the lives of miners and assure them every possible safeguard, yet the very men who clamor to have these safeguards established, ignore them, and if one happens to catch a wrong-doer, and he is subjected in consequence to a lay-off for a few days, or, as the case may be, to discharge, a strike is very apt to result, unless the culprit is reinstated. It is practically impossible to obtain a miner's testimony against another miner, in cases of any violation of the regulations governing a mine, hence the great difficulty to prevent these oft recurring disasters.—*Black Diamond.*

IRON STEEL AND HEAVY METALS.

Iron and Steel.

Montreal, March 24th, 1891.—Notwithstanding the strong statistical position of the British pig iron market, the apparent firmness which displayed itself about the close of last month has given way to a general depression, and we have to report lower prices than have been current for some time past. Advices from Glasgow state that disgusted holders are selling out their warrants for pig iron, and rumors of financial troubles in London and discouraging reports about the general condition of the trade are for the moment preventing any fresh buyers coming on. Scotch warrants, which were selling about 46s, at the beginning of the month, have touched as low as 43s. 4d., which is their present figure. It is evident, however, that any signs of even a partial revival of trade would bring about an immediate re-action, as stocks in Scotland are still being decreased at the rate of 4,000 to 5,000 tons per week, which must sooner or later have a very steadying effect on the market.

The arrangement by which a few of the furnaces in Scotland were to be blown in has gone into effect, and about one-third of the total number are now in operation with non-union men. All the shipping brands, such as "Coltness," "Summerlee," "Calder," "Langloan," "Gartsherrie," "Carnbrae," "Govan," etc., are now to be had, and the fears of a scarcity of these irons for spring trade are now happily dispelled.

Prices for stock iron continue about the same, and a fair quantity of "Summerlee" has moved out during the month at prices ranging from $23 to $23.50 ex-store Montreal, while a good business has been done in some of the lower grades such as "Carnbrae" and "Eglinton," at about $1.50 to $2 less. Stocks in Montreal are not excessive, and it is fully anticipated that they will all be required before the opening of navigation, as buyers did not lay in any considerable quantity in the fall, and are now beginning to run short. For the spring trade it is expected that prices will be low enough to compete favorably with American irons, not only in Montreal but also in the West. It is anticipated, however, that the demand will not be very large in the early part of the season, owing to the rather unsatisfactory condition of the agricultural implement trade. Manufacturers of these machines are proceeding very cautiously, and do not care to manufacture largely until they are assured of a more satisfactory state of affairs than last season. This business, however, is in very strong hands, as the smaller manufacturers have been gradually absorbed by the larger ones, and these are well able to bear any temporary strain.

In connection with the introduction of American pig iron into Western Canada, it is worthy of notice that it has caused iron founders to pay more attention to their mixtures, and to the analysis of the irons they use, than they have done before. In the United States almost all pig iron is sold according to analysis, while the various Scotch brands which have been used in Canada vary so little that they have been used from year to year without any enquiry as to their analysis. It is well to note, however, that the Scotch furnaces are quite as far ahead as the American, and their manufacture is conducted with as much attention to this point as in any blast furnace on this side of the Atlantic.

Finished irons are also slightly easier than they were a month ago, and we understand that Canadian iron is now being sold at $2.10 to $2.15 per 100 lbs. in Montreal, while English bars are quoted $2.25 to $2.30. It is only, however, for special work that the latter are brought in, and only the finer brands are wanted for this.

The demand for tin plates continues, although the works in South Wales are now fully loaded up with orders for shipment before the new American tariff comes into operation. Consumers in Canada are buying only what they actually require for their immediate wants, as there is no doubt that they will be able to do better for shipment after the month of June than can be done at present. Coke tin plates are quoted at $4.50 to $4.75 in Montreal, while charcoals range from $4.75 up to $5.50 according to quality.

Makers have not begun to make any Canada plates yet, but they will start at this work immediately after the demand for tin plates is satisfied, as both these articles are made by the same people.

No change of any importance has taken place in the other departments of this trade, and copper, tin, zinc, etc., remain unchanged.

London, March 15, 1891.—The general position is very quiet, and all the current indications seem to point to a more irregular demand, a gradual lowering of selling prices, and the inevitable reduction of wages and fuel. All these forces are already in operation, not only in Great Britain but also in every iron making country of the world; hence they must be recognized as being the natural sequence of the recent period of abnormal activity. Labour has received several severe checks in regard to the more arrogant pretensions of the trade-union leaders, and it is destined to retreat many points before circumstances again place it in a position to dictate to Capital. The blast-furnacemen in Scotland, for instance, have been completely defeated, and have not only failed to secure extra pay, but are resuming work at a 20 per cent. reduction. There are now twenty furnaces at work in Scotland, and more will be restarted almost immediately, so that the output of Scotch pig will be enlarged, and a check put upon the importations into Scotland from Middlesborough. Warrants are declining in value somewhat considerably, and the odds are that they will go several shillings lower before a state of equilibrium is reached—particularly if the reserve stocks should be increased. At present Connal's Glasgow stores contain 542,000 tons, as against 857,254 a year ago and 1,032,922 tons in 1889. All warrants are neglected, and the general demand for pig iron is dull. Buyers are holding back for rather lower prices, as they are enabled to do, owing to the quietude of the demand for their own productions. The call for many kinds of machinery, implements, and ironwork is still good, nevertheless; but merchant iron is slow, and the outlook is not brilliant. There is a softening of fuel prices, but there is yet room for a much more marked fall.

Liverpool, March 15, 1891.—There is a slight improvement in the tin-plate market here, there being a better demand and greater disposition on the part of both buyers and sellers to come to business. Bessemer steel cokes are again saleable at 17s. 6d. (Wales), and there are numerous buyers offering 17s. 3d. and 17s. 4½d., but no sellers at these figures at present. The improved demand has been chiefly for Bessemer and Siemens steel coke tins, and to a limited extent also for charcoal tin-plates, but there is still nothing doing in terne plates, and What has become of the orders for these? is a question that is exercising a great many peoples' minds just now. Bessemer tins now range in price from 17s 6d. to 18s. I C Wales; Siemens-Martin steel cokes, 18s. to 19s. I C; charcoal tin-plates, 19s. to 21s. 6d.; best charcoal tin-plates, 22s. to 24s. I C; terne plates, 31s. 6d. to 36s. The exports last month were 32,895 tons, as compared with 24,566 tons during the corresponding month of last year, and 33,971 tons during the same month of the previous year. For the first two months of this year the quantity exported was 72,322 tons, as compared with 56,734 tons during the corresponding period of last year, and 71,649 tons during a similar period of the previous year. The stocks in this country on the 1st inst. were 483,476 boxes, as compared with 498,164 boxes on the 1st ult., or a decrease of 14,688 boxes. Tin £90 5s. to £90 10s. Scotch pigs 45s. 4d. to 45s. 6d The shipments last week were 2,835 tons, as compared with 6,606 tons during the corresponding week of last year. Middlesborough, 40s. 7d. to 40s. 9d.; hematites, 49s. 6d. to 49s. 9d.

Scotch Pig Iron Warrant Market.—Below is given our usual table of the position of the warrant market:—

	1891.	1890.	1889.	1888.	1887.
Scotland.					
Price of Scotch warrants, Mar. 10	45/4½	50/5	43/11	38/10½	43/3
Furnaces in blast in Scotland, Mar. 10	20	89	81	85	71
Quantity of iron in public stores	542222	857254	1032942	956811	850201
Shipments of Scotch pig iron for week ending Mar. 7.	2880	6822	6138	6769	10690
Do. since beginning of year..	38093	69783	75622	66790	80102
Middlesboro' iron imported at Grangemouth, week ending Mar 7	10620	2650	7361	6785	4315
Do. since beginning of year..	66090	27034	72828	68315	62798
Cleveland.					
Price of Middlesbro' No. 3, warrants on Mar. 10	40/7½	50/-	37/-	31/3	35/-
Furnaces in blast in Middlesbro' district	97	106	99	96	90
Quantity of iron in public stores*	128088	172521	255312	334407	321532
Shipments of pig iron from Middlesbro' for week ending Mar. 7	16700	11383	19651	16730	16521
Do. since beginning of year..	135098	99523	156841	155135	128152
West Cumberland and North Lancashire.					
Price of hematite M/Nos. warrants	49/7	63/-	47/1	41/10½	45/6
Furnaces in blast in W. Cumberland and N. Lancashire	40	55	45	48	52
Quantity of iron in public stores†	197876	373445	437687	428470	300765
Shipment of hematite iron for week ending Mar. 7	12010	8035	9597	7643	14594
Do. since beginning of year..	82324	104919	93936	92480	98816

* Connal's & N. E. Rly. Co's.
† Workington, Maryport, and Barrow.

New York, March 24, 1891.—There has been nothing of particular moment to note in the general position of prices, or in the volume of business doing, for some little time. The buying is of a very hand-to-mouth character, buyers being contented to fill their immediate wants only. Perhaps on the whole, there has been a better feeling evinced of late, but the market is decidedly dull. Prices continue firm, and there are no reports of any concessions being made. This feeling is of course due to the less pressure to sell, since the reduction in stocks of iron has become pronounced; and the market is in a measure relieved of that incubus hanging over it. The coke strike still continues, although late dispatches from the Connellsville region indicate that it is weakening, and that an early settlement may be effected. That this has had no more influence is an evidence of the overstocked condition in which the iron market has been. Dealers report somewhat more inquiry for American pig iron, but no increase in orders, and the market is inactive. Prices are held firmly, and no shading on any brands is reported. The scarcity of No. 1 Southern iron is still pronounced, and dealers are unable to fill orders. No. 2 Southern iron is offering rather more freely. We quote Northern No. 1 X, $17.50@$18; Northern No. 2 X, $16.50@$17; Southern No 1 X, $17.50@$18; Southern No. 2 X, $16.50@$17. There has been very little doing in spiegeleisen and ferro-manganese, and the transactions have been limited. Prices of ferro-manganese, however, are a little firmer on account of the rise abroad. We quote, nominally: 20% spiegeleisen, $28.50@$29; 80% ferro-manganese, $63.50 @$64.50.

Cleveland, O., March 23, 1891.—The market has been dull for some weeks past, with very little movement. The price of pig iron still keeps down, although there is an actual scarcity of raw material. The reason for this state is found, to a large extent, in the falling-off, among the consumers, of orders, which, it was thought, would be forthcoming early in the spring, but which are still being withheld. Bessemer iron and a high-grade, all-ore foundry (No. 1) sell at about $17 at the furnace, where, indeed, there is any for sale. In the lines of manufactured iron there is very little that is encouraging. Bar iron is selling at $1.65 in large lots, and even that is an improvement, as but a short time ago a lot was sold at $1.57½. Sheets are also a trifle weak, but no more so than is usually the case at this time of the year. No. 24 is held at, say, $2.75, and No. 27 is worth fifteen cents more. In all the other lines there is but little activity, save in the combination makes, which are held up pretty stiffly to the full price.

Copper.—At length there has been a stiffening in copper in the American copper market on all grades. The second-hand offers of Lake copper have almost entirely disappeared, and it is questionable if anything can be obtained below 14c., at which price the Lake companies remain sellers. Arizona copper is exceedingly scarce. Pig copper is almost unobtainable for spot or near delivery, as large quantities have lately been shipped for export. Arizona ingot copper is held for 12⅞c@13c. Casting copper is also firmer. Small consumers have lately been able to purchase at about 11¼c in New York, but later on at this price pretty heavy transactions took place in the different brands, and now a firmer tendency prevails and we hardly think that anything is obtainable now below 11⅜c@11½c. The deliveries have been heavier in the last few days than for some months.

Lead.—Lead has been strong in the States, and a good business has been done at firm prices. Stocks appear to be small everywhere, and, with the demand at this time of the season becoming larger, it may reasonably be expected that prices will harden. New York quotations are: 4⅜c@4 40c. for near deliveries, but future deliveries are rather firmer and not obtainable below 4.45@4.50c.

The London market has been steady at £12 12s. 6d. for Spanish and £12 15s. for English.

At St. Louis, lead is firmer and a shade high; 4.12½c. has been paid for a few special lots. Offerings are moderate, and the demand is slightly improving.

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The Influence of Low Temperatures on Steel.—The results of certain experiments in relation to the effects produced on steel by very low temperatures have been recently published by order of the French Minister of War. The experiments were undertaken to determine (1) the value of the co-efficients of dilatation of steel hardened and unhardened at low temperatures, and (2) the effect produced by very low temperatures on the strength of steel. It was observed that the difference of dilatation decreased very rapidly when the temperature fell below —30° Centigrade, tended towards zero between —100° and 150° Centigrade, and were scarcely appreciable beyond—100°. As to the effect of great cold upon the tensile strength of steel, it was concluded that the elastic limit and the charge of rupture both increase with the low temperature, for tempered as well as for untempered steel, that the elongation decreases with the temperature and that the striction also diminishes with the temperature. It was deduced from the tests that steel sustains no permanent damage from subjection to severe colds. As to the effects of very low temperatures in respect of the resistance to transverse shock, the conclusions arrived at were:—(1) The fragility of the steel increases as the temperature decreases. The untempered bars withstood, on an average, 14-6 blows at ordinary temperature, and 5-9 blows at the low temperature. The tempered bars withstood, on an average, 17 blows at ordinary temperature, and 12.6 at the low temperature. (2) A comparison between the tempered and untempered bars shows that under the action of the cold the fragility of the untempered bars increases in a large proportion. (3) The stiffness increases as the temperature diminishes. The broad results of the experiments are set forth in the following terms:—Under the influence of severe cold the molecular state of steel is modified temporarily as follows:—The elastic limit, the breaking load, the hardness and the stiffness increase as the temperature diminishes, the fragility under shock also increases, and the elongation decreases. These modifications have not a permanent character, and the metal returns to its original state under the ordinary temperature.

The cost of making Tin-plates.—According to a "Retired Ironmaster," who says he has followed the course of the tin-plate industry in England and America for the last twenty years, tin-plates could be profitably made even now in the United States. He gives the following figures as to the prime cost:

Calculation showing at what cost tin-plates can be manufactured at various points in the United States.

2,240 lbs. of steel billets, freight paid		$26.00
5 per cent. waste in heating the same		1.30
7 per cent. crop-ends	$1.82	
Less available scrap	1.40	
		0.42
Labor in bar-mill, heating and rolling		2.25
Fuel (coal at 1.25 per ton)		0.75
2,240 lbs. tin-plate bar		$30.72
Sheet scrap, 15 per cent	$1.68	
Less available scrap	1.53	
		3.11
Tonnage labor in sheet-mill, Amalgamated Association rates		14.40
Total		$48.23
60 lbs. acid for black pickling at 1½c.		0.90
Waste in pickling, 2 per cent		0.97
Pickler, per ton		1.50
Annealer, per ton		1.00
Fuel for sheet-mill and annealing (1 ton coal)		1.25
Cold-rolling (smoothing plates)		1.00
Total		$54.85
Wear and tear, repairs and maintenance		3.50
Day labor and salaries		9.50
Current and incidental expenses		3.00
2,240 lbs. black plate ready for tinning		$70.85

(Cost per lb. 3.16c.)

Hence the following estimate of the cost of one box of tinned plate:—

100 lbs. of I.C. short-weight plates per box	$3.16
2 lbs. acid for white pickling at 1½c	0.03
Pickler's wages	0.08
1 lb. palm oil	0.06
2 lbs. flux (muriatic acid and zinc) at 2 c.	0.04
2½ lbs. pig tin at 21c.	0.53
Bran or middlings	0.03
Tin-house labor	0.30
Fuel	0.03
Incidentals	0.10
Box	0.12
Loss on one box wasted out of every ten = $1.	0.10
Total	$4.58
10 per cent. profit added	0.46
Average freight to market	0.25
Cost of one box of coke tin	$5.29

This is the cost, he says, of plates about equal to Penlan grade, which is now quoted at New York at $5.40. For plates equal to Melyn the cost is put down at $6.25. He estimates that it would cost about $160,000 to build and equip the works necessary to produce the plates, and on a production of 65,000 boxes a year he figures out that the profits ought to be $32,500 per annum, at an average gain of 50c. per box. In connection with this subject it may be of interest to look at the following statement of the cost of making good common sheet iron of No. 27 gauge at the American works:—

2,240 lbs. muck bar		$27.00
7 per cent. waste in reheating		1.89
7 per cent. crop-ends	$ 1.89	
Less available scrap	1.40	
		0.49
Bar-mill labour		2.25
Fuel		0.75
Cost of 2,240 lbs. finished sheet bar		$32.38
15 per cent. scrap in sheet-mill	$ 4.86	
Available at	1.50	
		3.36
Sheet-mill labour, per ton		10.30
Annealing		1.00
Fuel for mill and annealing		1.25
Total		$48.29
Repairs and manufacturing expenses		3.00
Day labour and salaries		8.50
Current and incidental expenses		3.00
Cost of 2,240 lbs. No. 27 gauge		$62.79

This is equal to about £12 11s. per ton, or a good deal more than the equivalent prime costs in England.

Wages of Scotch Furnacemen.—The following are the rates of furnacemen in Govan Ironworks, Scotland:—Hematite brands—Keepers (in charge of furnace), 4½d per ton; shift wages, 5s 10d; assistants, 3½d per ton; shift wages, 4s 6d; fillers, 4¾d for Nos. 1, 2 and 3 brands, 4½d for No. 4 brand; shift wages, 5s 6d; pig lifters, 5¼d per ton, with no shift wages. Ordinary brands—Keepers, for No. 1 brand 5½d, for No. 3 brand 3⅞d; shift wages, 5s 6d; assistants, for No. 1 brand 3⅝d, for No. 3 brand 2⅝d; shift wages, 3s 10d; fillers, for No. 1 brand 4⅞d, for No. 3 brand 3⅞d; shift wages, 5s 1d; pig lifters' shift wages, 5s 1d; scale men, 4s 7d. The masters also make an all round deduction of 7½ per cent. for sand, and when selling off allow 2½ per cent., being a general deduction of the above rates of 5 per cent. Dixon's furnace men state that these rates are from 5 to 10 per cent. lower than those allowed at Coltness.

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The Basic Process as Applied to Copper Smelting.

At a meeting of the English Society of Chemical Industry, Mr. Percy C. Gilchrist read a paper on basic copper smelting. Arguing from the great advantages which ensue from the replacement of the ordinary siliceous linings of steel smelting furnaces by a lining composed of basic material, when phosphoric pig iron has to be converted, the author thought it might reasonably be expected that the substitution of a basic lining for the siliceous lining hitherto employed in copper smelting furnaces should also be followed by similarly advantageous results, especially when the cupriferous material to be treated contains any notable percentage of arsenic or antimony.

In the case of steel manufacture, the result aimed at in substituting a basic lining for the acid was well defined—viz., the removal of phosphorus, a problem incapable of solution in acid lined furnaces, owing to the acid nature of the slags necessarily formed with such linings, but which was readily accomplished so soon as the presence of a basic lining in the furnace allowed of a basic slag being formed and maintained. No such direct improvement, however, was to be looked for in the case of copper smelting, as the only deleterious element occuring with any frequency in crude copper, viz., arsenic, can be very perfectly eliminated in the acid lining at present made use of. A careful study, however, of the composition of copper roaster and refinery slag reveals the fact that, unlike steel slags from acid practice, the copper slags formed during the removal of the arsenic are basic and not acid in character, the basicity being chiefly due to the presence of copper oxide in quantity more than sufficient to neutralise the silica, which latter, in the roaster and refinery furnace, originates almost wholly from the sand or clay used to form the furnace bath. Lime or lime and soda ash are used very generally in the ordinary sand lined refinery, but the quantity which can be added without detriment to the lining is not large, and does not compensate for the large amount of siliceous material which is dissolved away from the sides of the furnace. It was therefore rather in the direction of lessened oxidation, and therefore in-

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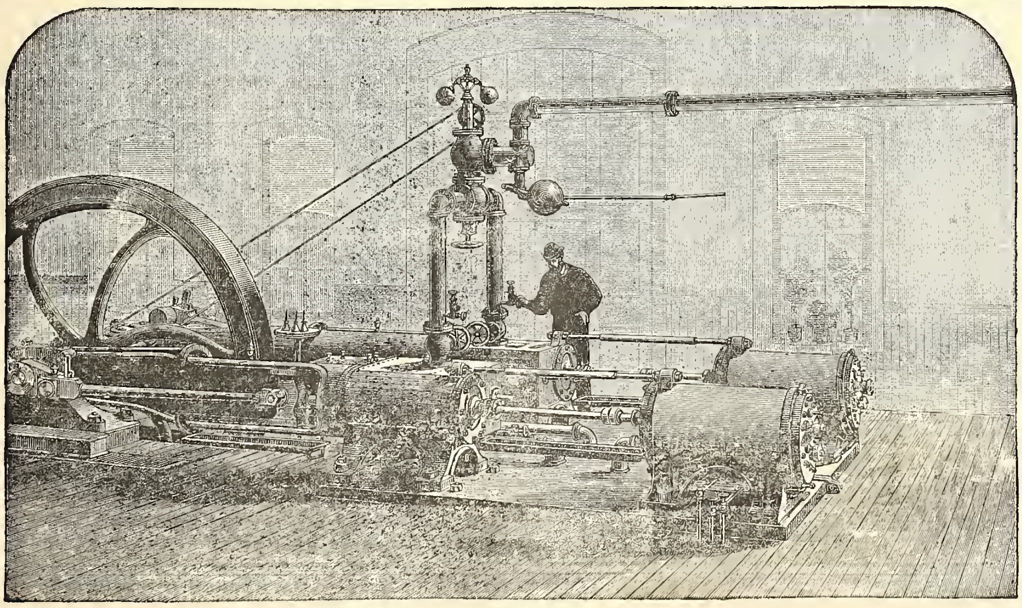

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creased yield, that the author expected improved results by the use of basic linings and more calcareous slags in copper smelting.

In May, 1889, the technical adviser of one of the largest copper-smelting companies was exceedingly anxious to make a trial of a basic lining in one of their roaster furnaces. This lining was accordingly put in and is still in perfect condition. The results obtained with this first lining were so satisfactory that at the present time the company have nine roaster furnaces at work treating arsenical "metallic bottoms" and white metal. As the old roaster furnaces require renewing, they are being rebuilt with basic hearths, so that, shortly, probably all the roaster furnaces employed at these works will be furnished with basic linings. These roaster furnaces have cast-iron bottom plates, underneath which a free current of air circulates; by this means the bottom of the furnace is kept cool, it likewise prevents the possibility of any fusing action taking place between the basic hearth and its support, which might be the case were the basic hearth built directly upon the ordinary silica arch. The basic material is ground and mixed with tar in the usual way, and the furnace bottom is formed by throwing this material into the hot furnace and burning it on in layers, well beating down each separate layer and giving it fire for some hours before applying a fresh layer. It usually takes four or five days to burn on a bottom in this way, When the bottom is properly shaped it should be seasoned by melting on it some rich copper precipitate or good blister copper. It was at first considered that the basic hearth absorbed less copper than the ordinary sand ones, but there appears to be very little, if any, difference between them, much depending on the way the bottom is formed and seasoned. The tap-hole of the furnace is shut by throwing a little basic material against it from the inside. In other respects, the working of the furnace is conducted in the usual way. After each charge any slight repairs that the banks may require are made by throwing some basic material against the place needing repair; the repairs required are, however, very slight in comparison with an acid furnace, the tendency being for the furnace banks to grow rather than to cut away.

The mineral in use at these works is arsenical, and although in the crude ore the arsenic is not high, yet when the ore is allowed to oxidise in heaps and the copper afterwards precipitated from the solution, obtained by lixiviating the ore, arsenic is concentrated in the precipitated copper to a considerable extent, the resulting precipitate usually containing some 3 to 3½ per cent. of arsenic. Very large quantities of this precipitate are treated. It is added to the mixture of slag and metal charged into the smelting furnace, and according to the amount of precipitate so added to the charge, more or less of the product tapped from the smelter consists of impure copper, known as "metallic bottoms." An average analysis of these bottoms gives:—Copper 83 to 87 per cent.; arsenic, 5 to 7; sulphur, 1 to 3; iron, 0·5; lead, 3 to 5; silica, 0·5. It is in the conversion of these metallic bottoms into blister copper containing under 1 per cent. of arsenic that the basic furnaces have shown themselves to the greatest advantage. Calculations show that taking the real copper in the "metallic bottoms" at 84·5 per cent., and the real copper in blister at 98·5 per cent., there was obtained in the form of blister 94 per cent. of the real copper from the basic furnace and 56 per cent. of the real copper from the acid furnace, showing a gain of 38 per cent. in favour of the basic furnace. The real copper in the slag works out to 25 tons 14 cwt. from the basic furnace, and 121 tons 19 cwt. from the acid furnace.

In addition to the largely-increased yield of blister obtained from the basic furnace over the sand-lined furnace when treating metallic bottoms, there is a further advantage, viz., that these metallic bottoms have a most deleterious effect upon the sand lining of the furnaces, the bottom nearly always requiring repair after three or four days' working.

After carefully investigating the results obtained from the substitution of a basic lining in the roaster furnace for the ordinary sand lining, it was resolved to test whether any substantial improvement resulted from a similar change in the refinery furnace. The margin for improvement in the case of the refinery furnace is far less than in the case of the roaster furnace process; it is therefore still a little uncertain whether the extra cost of the initial basic lining and of the current repairs are compensated for by the slightly increased yield, when making ordinary tough cake. When, however, it is a question, not of making ordinary tough cake, but of producing best selected copper from ordinary arsenical blister (containing about 1 per cent. of arsenic) there is, in the author's opinion, a very great saving in waste effected by the use of a basic lining in the refining furnace.

The basic refinery has so far been used chiefly for the production of best selected copper from B. S. precipitate only, or from pure blister containing only some ·2 to ·3 per cent. of arsenic, but some charges have recently been made from blister containing 1 per cent., and which have been worked down into B. S. ingots with very good results as regards yield, but as might naturally be expected, longer time is required.

Summing up, therefore, the results so far obtained in basic copper smelting, it would seem that where the basic process has shown itself to be of most use is in the treatment of highly arsenical material tapped from the smelting furnaces. Such material, being produced from the poorer arsenical precipitates, generally gives a great deal of trouble in the ordinary way of working, with a very high loss of copper in the slags, which necessitates extra labor and expense to rework. Another very important point to which the basic process shows itself well adapted is in the refining of blister rather high in arsenic (say from 1 to 1½ per cent. or higher) for the purpose of making B.S. ingots.

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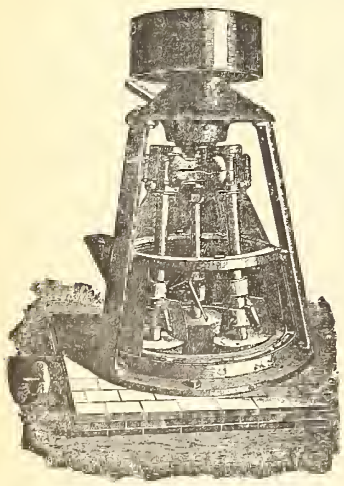

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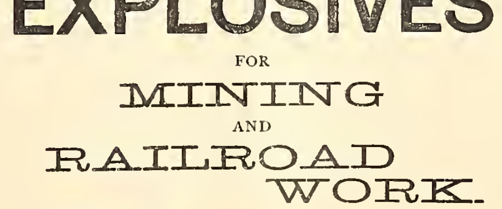

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This Company will arrange to connect places not having telegraphic facilities with the nearest telegraph office. or it will build private lines for firms or individuals, connecting their places of business or residence. It is also prepared to manufacture all kinds of electrical apparatus.

Full particulars can be obtained at the Company's offices as above, or at St. John, N.B., Halifax, N.S., Winnipeg, Man., Victoria, B.C.

LEDOUX & COMPANY,
9 Cliff St., New York.
Engineers, Metallurgists & Assayers.

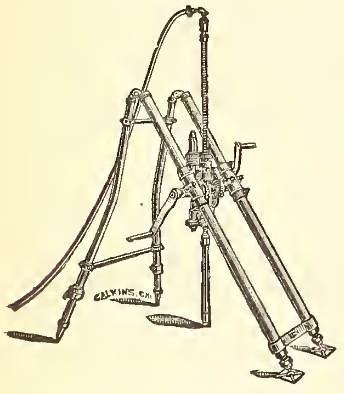
Public Ore Sampling and Storage Works

All the principal buyers of furnace materials in the world purchase and pay cash against our certificates of assay, through New York banks.

By special permission of the Secretary of the Treasury of the United States, cars of ore or Copper matte passing through in bond can be opened and sampled at our works.

Consignments received and sold to highes. bidder. Send for circular giving full particularst

Mines examined and sampled. Assays and Analyses of all kinds.



"M" Drill--Hand Power.

Capacity—300 ft. depth.

Removes $1\frac{3}{16}$ inches solid core.

DIAMOND DRILLS
FOR
PROSPECTING MINERAL LANDS.

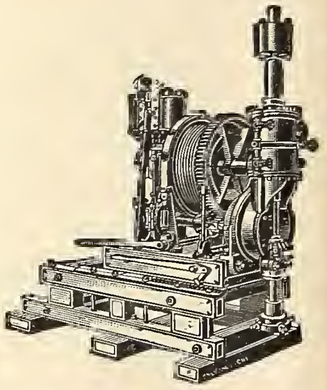
The Sullivan Diamond Drill is the **simplest, most accurate,** and **most economical** prospecting drill for any kind of formation, hard or soft, in deep or shallow holes.

The Diamond Drill brings to the surface a **solid core** of rock and mineral to any depth, showing with **perfect accuracy** the nature, quality and extent of the ore-bearing strata, and with great **saving in time and expense** over any other method.

Complete stock of all sizes, driven by hand or horse power, steam, compressed air or electricity. For sale by

DIAMOND PROSPECTING CO.,
15 & 17 N. Clinton Street, - CHICAGO, ILL., U.S.A.

AGENTS FOR
Sullivan Diamond Prospecting Drills, Channeling Machines, Rock Drills, Hoists and other Quarrying Machinery.
Hoisting and Hauling Engines, Cages, Tipples, and other Coal Mining Machinery.
Contractors for Prospecting Mineral Lands with the Diamond Drill.



"N" Drill—

Capacity—2,000 ft. depth.

Removes $1\frac{7}{8}$ inches solid core.

J. S. HOSSACK, President. C. ANDERSON, Secretary-Treasurer. T. J. CARROLL, General Manager.

HAMILTON BRASS MFG. CO.,
MANUFACTURERS OF
ENGINEERS' AND PLUMBERS' BRASS GOODS.
BRASS TUBING AND ALL KINDS OF BRASS CASTINGS.
259 & 261 James Street N., - - - - - - - - HAMILTON, ONT.

STATIONERY, MARINE, PORTABLE, AND LOCOMOTIVE BOILERS.

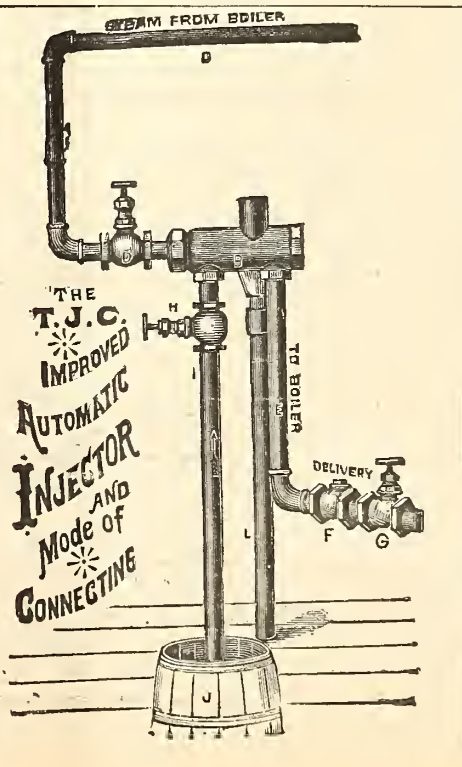
Simple, Reliable and Durable. Every Injector Guaranteed for Two Years.

Range, 25 to 150 lbs., and is the only Automatic Injector in the world that can be operated by opening one valve, and that the overflow. Can have a pipe connected to conduct the overflow to tank or sewer. The only Injector having a Signal Valve to show when the Injector is working; all other boiler feeders not having this cannot be connected to return the overflow to tank or sewer.

OUR PROPOSITION:

As every Injector is tested before it leaves the factory, we know that if properly connected (as in diagram) and instructions are carried out, they cannot fail to work. We therefore offer to **pay the expenses** of any man to come to the factory, and **$25.00 per day while there** if the Injector does not work, provided it has not been misused.

As the body will last for years, it is only necessary to order working parts to make injector good as new. Every purchaser can repair his own Injector without sending it to the factory.


STEAM FROM BOILER
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THE T.J.C. IMPROVED AUTOMATIC INJECTOR AND Mode of CONNECTING
H
TO BOILER
DELIVERY
L
F
G
J

Number.	Price.	Horse Power.
7½	$ 4 50	4 to 8
8¾	6 00	8 to 12
10	7 00	12 to 16
12½	9 00	16 to 28
15	10 50	28 to 40
17½	14 00	40 to 57
20	15 00	57 to 72
22½	21 00	72 to 93
25	22 50	93 to 120
30	27 00	120 to 160
35	30 00	160 to 220
40	35 00	220 to 290
45	38 00	290 to 308

3|750. 83

PROVINCE OF NOVA SCOTIA.

Leases for Mines of Gold, Silver, Coal, Iron, Copper, Lead, Tin

—AND—

PRECIOUS STONES.

TITLES GIVEN DIRECT FROM THE CROWN, ROYALTIES AND RENTALS MODERATE.

GOLD AND SILVER.

Under the provisions of chap. 7, Revised Statutes of Mines and Minerals, Licenses are issued for prospecting Gold and Silver for a term of six months, which can be extended by renewal for another six months. Mines of Gold and Silver are laid off in areas of 150 by 250 feet, any number of which up to one hundred can be included in one License, provided that the length of the block does not exceed twice its width. Up to ten areas the cost is 50 cts. per area, for every area in addition in same application 25 cents. Cost of renewal one half the original fees. Leases of any number of areas are granted for a term of 21 years at $2-00 per area. These leases are forfeitable if not worked, but advantage can be taken of a recent Act by which on payment of 50 cents annually for each area contained in the lease it becomes non-forfeitable if the labor be not performed.

Licenses are issued to owners of quartz crushing mills who are required to pay Royalty on all the Gold they extract at the rate of two per cent. on smelted Gold valued at $19 an ounce, and in smelted gold valued at $18.00 an ounce.

Applications for Licenses or Leases are receivable at the office of the Commissioner of public Works and Mines each week day from 10 a.m. to 4 p.m., except Saturday, when the hours are from 10 to 1. Licenses are issued in the order of application according to priority. If a person discovers Gold in any part of the Province, he may stake out the boundaries of the areas he desires to obtain, and this gives him one week and twenty-four hours for every 15 miles from Halifax in which to make application at the Department for his ground.

MINES OTHER THAN GOLD AND SILVER.

Licenses to search for twelve months are issued, at a cost of twenty dollars, for minerals other than Gold and Silver, out of which one square mile can be selected for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

All rentals are refunded if afterwards the areas are worked and pay royalties. All titles, transfers, etc., of minerals are registered by the Mines Department free of charge, and provision is made for lessees and licensees whereby they can acquire promptly either by arrangement with the owner or by arbitration all land required for their mining works.

The Government as a security for the payment of royalties, makes the royalties first lien on the plant and fixtures of the mine.

The unusually generous conditions under which the Government of Nova Scotia grants its minerals have introduced many outside capitalists, who have always stated that the Mining laws of the Province were the best they had had experience of.

The royalties on the remaining minerals are: Copper, four cents on every unit; Lead, two cents upon every unit; Iron, five cents on every ton; Tin and Precious Stones; five per cent.; Coal, 7½ cents on every ton sold.

The Gold district of the Province extends along its entire Atlantic coast, and varies in width from 10 to 40 miles, and embraces an area of over three thousand miles, and is traversed by good roads and accessible at all points by water. Coal is known in the Counties of Cumberland, Colchester, Pictou and Antigonish, and at numerous points in the Island of Cape Breton. The ores of Iron, Copper, etc., are met at numerous points, and are being rapidly secured by miners and investors.

Copies of the Mining Law and any information can be had on application to

THE HON. C. E. CHURCH,

Commissioner Public Works and Mines,

HALIFAX, NOVA SCOTIA.

INTERCOLONIAL RAILWAY OF CANADA.

The direct route between the West and all points on the Lower St. Lawrence and Baie des Chaleur, Province of Quebec; also for New Brunswick, Nova Scotia, Prince Edward and Cape Breton Islands, Newfoundland and St. Pierre.

EXPRESS TRAINS leave Montreal and Halifax daily (Sunday excepted) and run through without change between these points in 30 hours.

The Through Express Train cars of the Intercolonial Railway are brilliantly lighted by electricity and heated by steam from the locomotive, thus greatly increasing the comfort and safety of travellers.

New and Elegant Buffet Sleeping and Day Cars are run on all through Express Trains.

CANADIAN EUROPEAN MAIL AND PASSENGER ROUTE.

Passengers for Great Britain or the Continent by leaving Montreal on Friday morning will join Outward Mail Steamer at Halifax the same evening.

The attention of shippers is directed to the superior facilities offered by this route for the transport of flour and general merchandise intended for the Eastern Provinces and Newfoundland; also for shipments of grain and produce intended for the European market.

Tickets may be obtained and all information about the route, also Freight and Passenger rates, on application to

G. W. ROBINSON,
Eastern Freight and Passenger Agent,
136½ St. James Street, MONTREAL.

E. KING,
Ticket Agent,
27 Sparks Street, OTTAWA.

Railway Offices, Moncton, N.B., 14th November, 1889.

D. POTTINGER, Chief Superintendent.

MAP

—OF THE—

Phosphate Region

—OF—

OTTAWA COUNTY, QUEBEC.

PRICE, TWO DOLLARS.

On sale only at the Offices

OF THE

CANADIAN MINING REVIEW,

OTTAWA.

MINING REGULATIONS

TO GOVERN THE DISPOSAL OF

DOMINION LANDS CONTAINING MINERALS, OTHER THAN COAL, 1890.

THESE REGULATIONS shall be applicable to all Dominion Lands containing gold, silver cinnabar, lead, tin, copper, petroleum, iron or other mineral deposits of economic value, with the exception of coal.

Any person may explore vacant Dominion Lands not appropriated or reserved by Government for other purposes, and may search therein either by surface or subterranean prospecting for mineral deposits, with a view to obtaining under the Regulations a mining location for the same but no mining location or mining claim shall be granted until the discovery of the vein, lode or deposit of mineral or metal within the limits of the location or claim.

QUARTZ MINING.

A location for mining, except for iron or petroleum, on veins, lodes or ledges of quartz or other rock in place, shall not exceed 1,500 ft. in length and 500 ft. in breadth. Its surface boundary shall be four straight lines, the opposite sides of which shall be parallel, except where prior locations would prevent, in which case it may be of such a shape as may be approved of by the Superintendent of Mining.

Any person having discovered a mineral deposit may obtain a mining location therefor, in the manner set forth in the Regulations which provides for the character of the survey and the marks necessary to designate the location on the ground.

When the location has been marked conformably to the requirements of the Regulations, the claimant shall within sixty days thereafter, file with the local agent in the Dominion Land Office for the district in which the location is situated, a declaration or oath setting forth the circumstances of his discovery, and describing, as nearly as may be, the locality and dimensions of the claim marked out by him as aforesaid; and shall, along with such declaration, pay to the said agent an entry fee of FIVE DOLLARS. The agent's receipt for such fee will be the the claimant's authority to enter into possession of the location applied for.

At any time before the expiration of FIVE years from the date of his obtaining the agent's receipt it shall be open to the claimant to purchase the location on filing with the local agent proof that he has expended not less than FIVE HUNDRED DOLLARS in actual mining operations on the same; but the claimant is required, before the expiration of each of the five years, to prove that he has performed not less than ONE HUNDRED DOLLARS' worth of labour during the year in the actual development of his claim, and at the same time obtain a renewal of his location receipt, for which he is required to pay a fee of FIVE DOLLARS.

The price to be paid for a mining location shall be at the rate of FIVE DOLLARS PER ACRE, cash, the sum of FIFTY DOLLARS extra for the survey of the same.

No more than one mining location shall be granted to any individual claimant upon the same lode or vein.

IRON AND PETROLEUM.

The Minister of the Interior may grant a location for the mining of iron or petroleum, not exceeding 160 acres in area which shall be bounded by north and south and east and west lines astronomically, and its breadth shall equal it in length. Provided that should any person making an application purporting to be for the purpose of mining iron or petroleum thus obtain, whether in good faith or fraudulently, possession of a valuable mineral deposit other than iron or petroleum, his right in such deposit shall be restricted to the area prescribed by the Regulations for other minerals, and the rest of the location shall revert to the Crown for such disposition as the Minister may direct.

The regulations also provide for the manner in which stone quarries may be acquired.

PLACER MINING.

The Regulations laid down in respect to quartz mining shall be applicable to placer mining as far as they relate to entries, entry fees, assignments, marking of localities, agents' receipts, and generally where they can be applied.

The nature and size of placer mining claims are provided for in the Regulations, including bar, dry, bench, creek or hill diggings, and the RIGHTS AND DUTIES OF MINERS are fully set forth.

The Regulations apply also to

BED-ROCK FLUMES, DRAINAGE OF MINES AND DITCHES.

The GENERAL PROVISIONS of the Regulations include the interpretation of expressions used therein; how disputes shall be heard and adjudicated upon; under what circumstances miners shall be entitled to absent themselves from their locations or diggings, etc., etc.

THE SCHEDULE OF MINING REGULATIONS

Contains the *forms* to be observed in the drawing up of all documents such as:—"Application and affidavit of discoverer of quartz mine." "Receipt for fee paid by applicant for mining location." "Receipt for fee on extension of time for purchase of a mining location." "Patent of a mining location." "Certificate of the assignment of a mining location." "Application for grant for placer mining and affidavit of applicant." "Grant for placer mining." "Certificate of the assignment of a placer mining claim." "Grant to a bed-rock flume company." "Grant for drainage." "Grant of right to divert water and construct ditches."

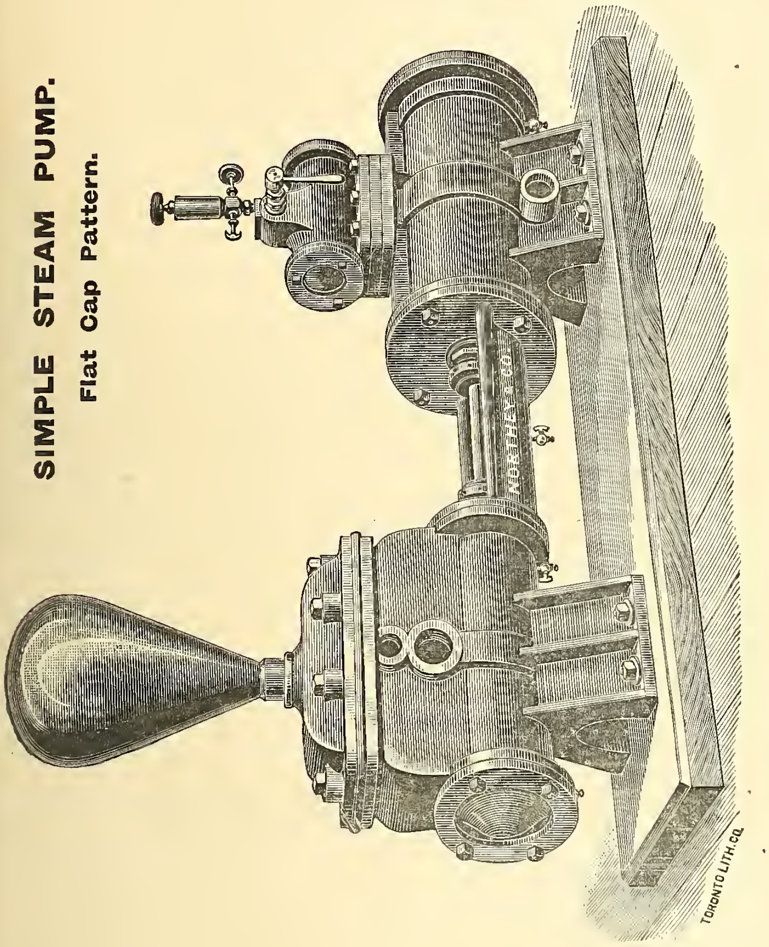
Since the publication, in 1884, of the Mining Regulations to govern the disposal of Dominion Mineral Lands the same have been carefully and thoroughly revised with a view to ensure ample protection to the public interests, and at the same time to encourage the prospector and miner in order that the mineral resources may be made valuable by development.

COPIES OF THE REGULATIONS MAY BE OBTAINED UPON APPLICATION TO THE DEPARTMENT OF THE INTERIOR.

A. M. BURGESS,
Deputy Minister of the Interior.

NORTHEY & CO'S STEAM PUMP WORKS,

Toronto, Ontario.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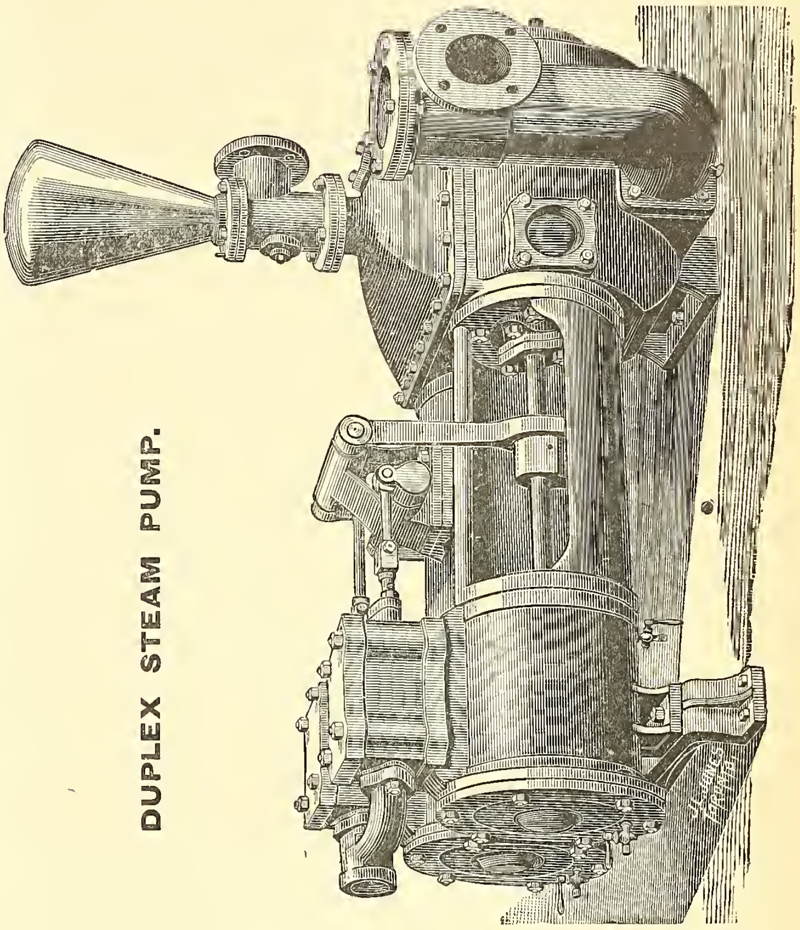
SIMPLE STEAM PUMP.
Flat Cap Pattern.



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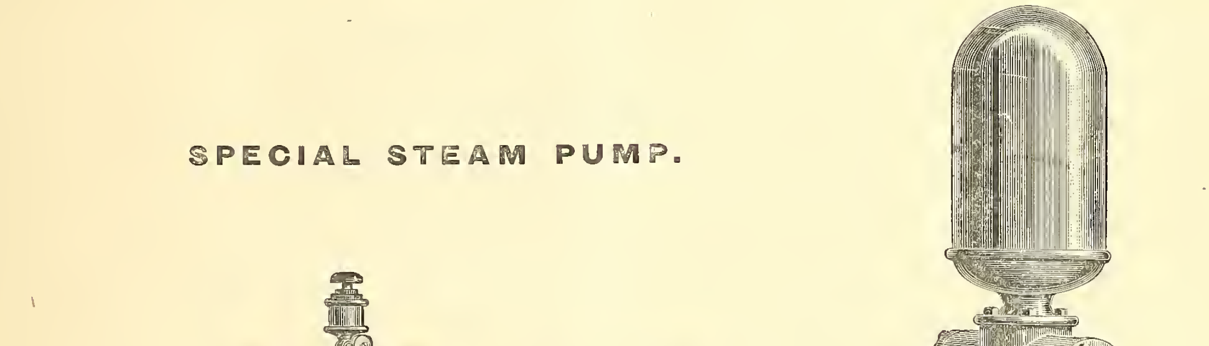
SPECIAL STEAM PUMP.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TORONTO, ONT.

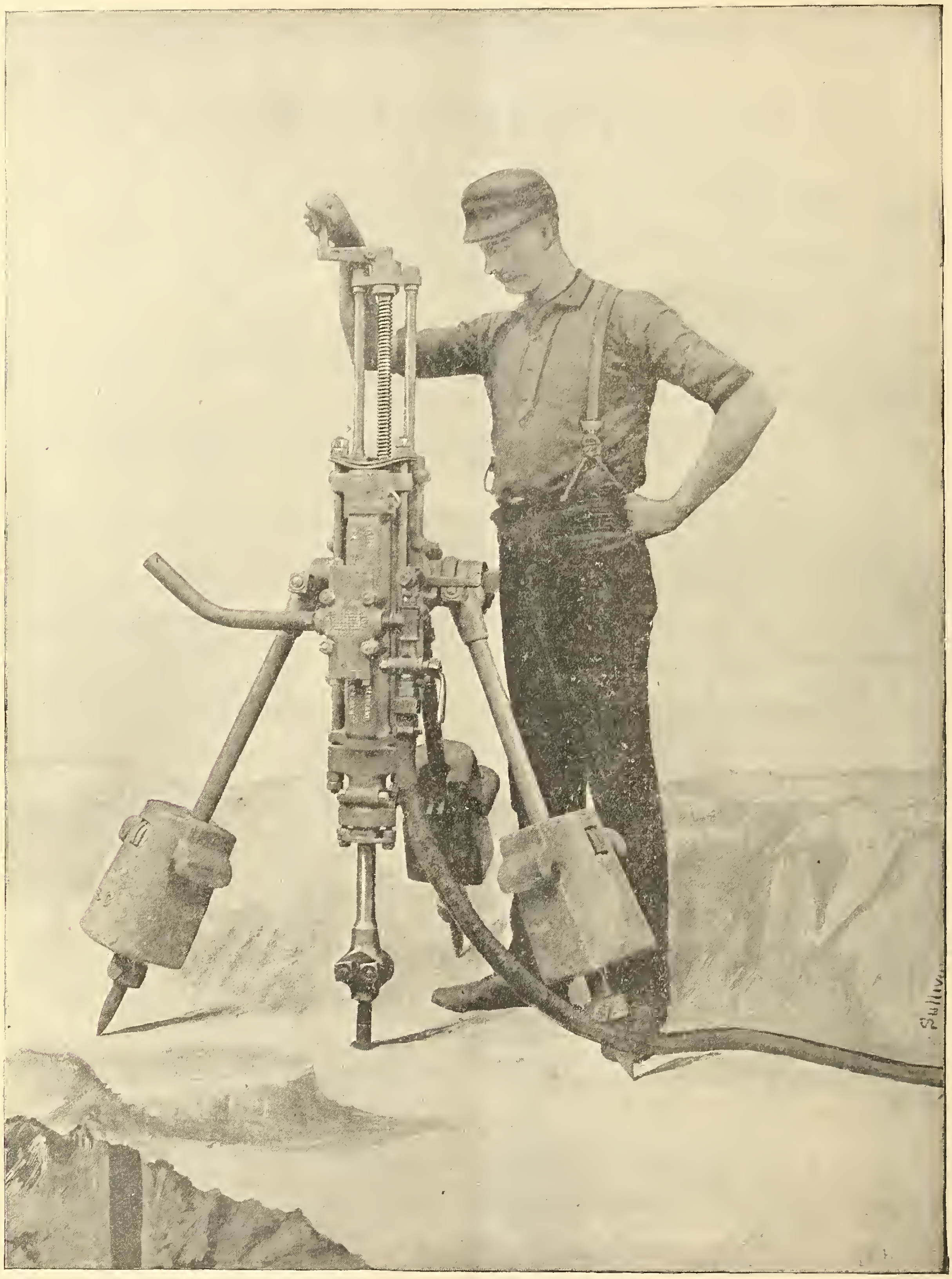
Steam Pumps of the best and latest designs for mining purposes, Boiler Feeding, Fire Protection, and General Water Supply, Etc.

NORTHEY & CO.,

Mechanical and Hydraulic Engineers, - - - - - - Toronto, Ont.

WORKS—CORNER FRONT AND PARLIAMENT STREETS.

Other important improvements in Mining Machinery will be illustrated on this page in the April issue.



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Embodying all the valuable features of the Ingersoll Drill, with a POSITIVE VALVE MOTION, giving A VARIABLE STROKE and STRIKING AN UNCUSHIONED BLOW. Every part made to templet and ABSOLUTELY INTERCHANGEABLE.

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204 St. James St., or P. O. Box 1942, Montreal.

Canadian MINING REVIEW

Established 1882

Vol. X.—No. 4. 1891—OTTAWA, APRIL—1891. Vol. X.—No. 4.

SEE INGERSOLL ROCK DRILL COMPANY'S ADVERTISEMENT ON BACK COVER.

SPECIAL

The Canadian Rand Drill Co.,

SHERBROOKE, QUE.

ORGANIZED FOR

The production of a better class of Rock Working Machinery than has been heretofore made in Canada.

SEE PAGE 109.

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Manufacture Mining, Blasting, Military and Sporting

GUNPOWDER,

Dynamite, Dualin,

AND THE NEW

ECLIPSE MINING POWDER.

DOMINION AGENTS FOR

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Branch Offices and Magazines at all chief distributing points in Canada.

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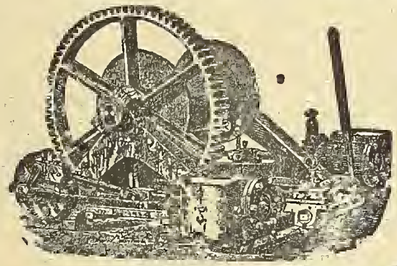

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STEAM ROCK DRILLS,

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BLACK DIAMOND STEEL WORKS. TRADE MARK LAKE SUPERIOR COPPER MILLS.

PARK, BROTHER & CO.,

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BLACK DIAMOND STEEL,

The Best for Mining and General Purposes.

Large and well-assorted Stock.

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Lands and Reservations

COVERING NEARLY

A Quarter of a Million Acres

In Eastern Ontario, and principally within the belts containing

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And other valuable Minerals, are issued by

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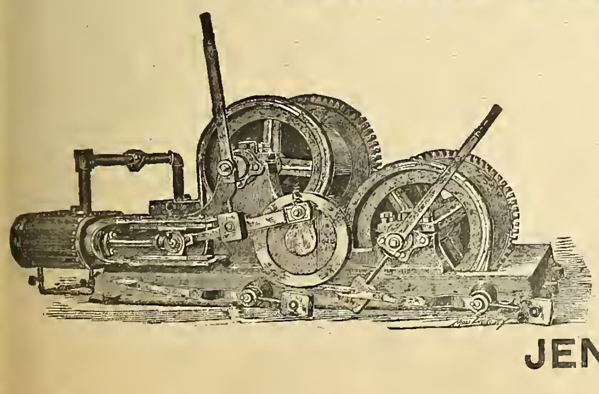
For list of lands and terms, apply to the Company's Mining Inspectors,

H. T. STRICKLAND,
Peterborough, Ont.,
For lands in the County of Hastings and Westward; and

ANDREW BELL, P.L.S.,
Almonte, Ont.,
For lands East of the County of Hastings.

BACON'S REVERSIBLE AND FRICTION

Hoisting Engines



For Mines, Inclines or Quarries, and every possible duty.
Double or Single Drums.

Complete Hoisting and Mining Plants

A SPECIALTY.

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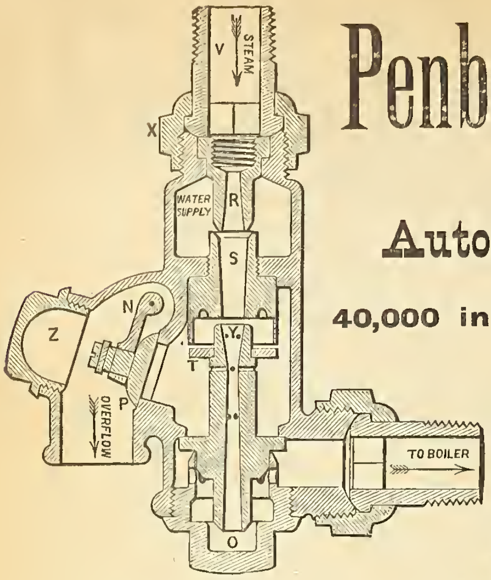
References—G. H. Nicholls & Co., Capelton; Bells Asbestos Co., Thetford Mines; American Asbestos Co., Black Lake; United Asbestos Co., Black Lake; Dominion Phosphate Co., Montreal.



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40,000 in use in the U.S. 8,000 in use in Canada.

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Haggart Bros., Brantford; John Doty Engine
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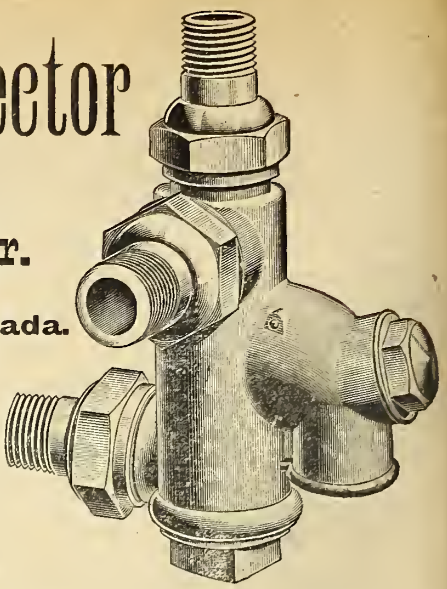

We guarantee them to work as follows:

They will lift from 18 to 20 feet and take a supply from a head as well without change of jets; they are absolutely automatic and restarting, without adjustment of valves if feed is broken from sudden jarring or air getting into suction pipe. For Traction, Portable and Stationary Engines, Boats, etc., they have no superior, They work from 20 and 25 pounds low, to 130 and 150 pounds high steam pressure, according to lift, and are the only *Injectors on earth that will lift through a hot suction pipe.* All jets are interchangeable, and can be *replaced by user* without breaking connections or sending Injector to factory to be repaired. High pressure Injectors furnished on application.

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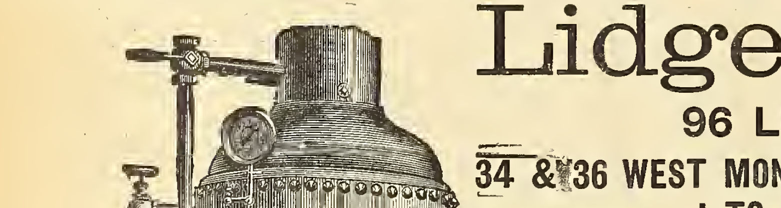

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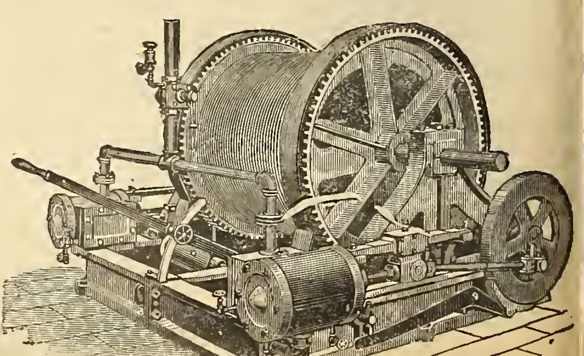

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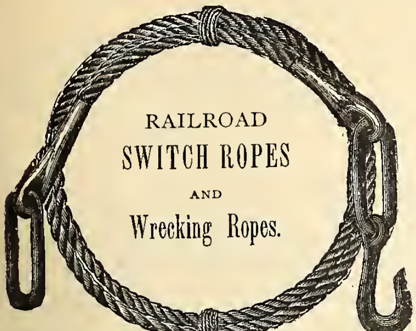

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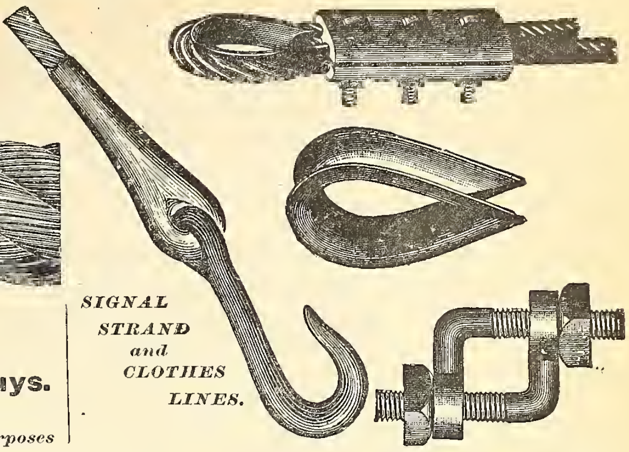

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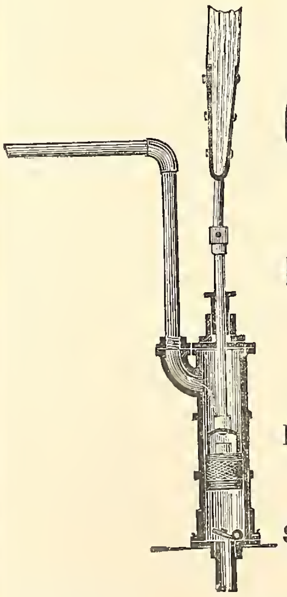

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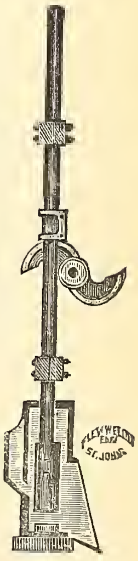

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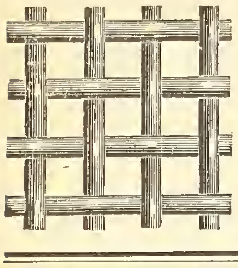

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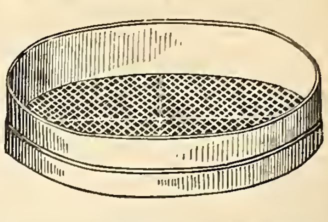

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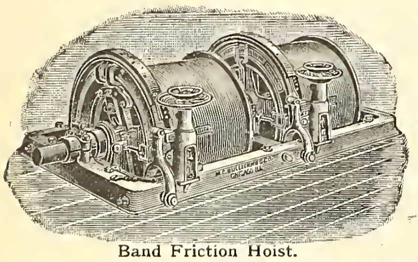

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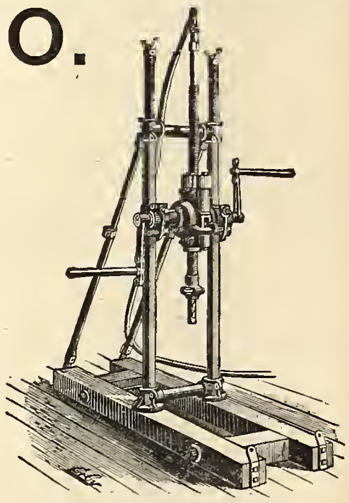

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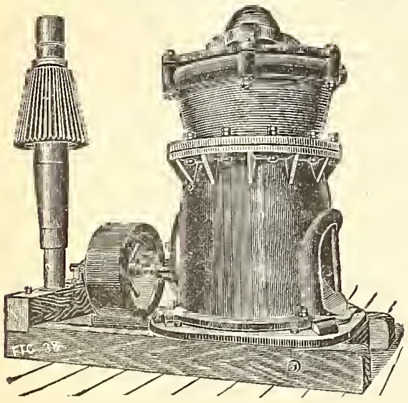

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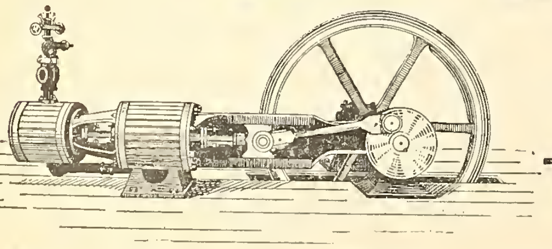

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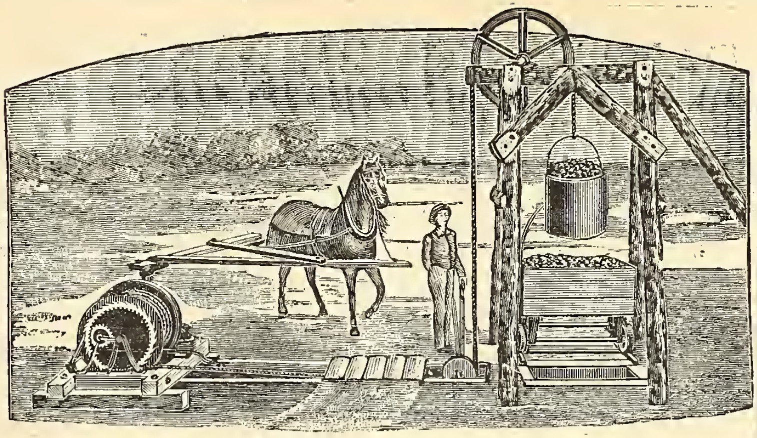

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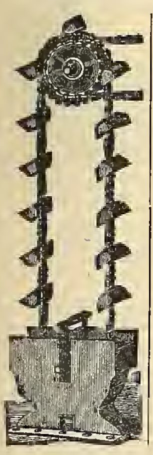

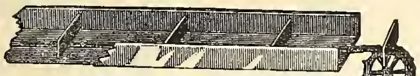

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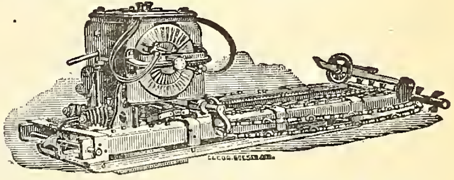

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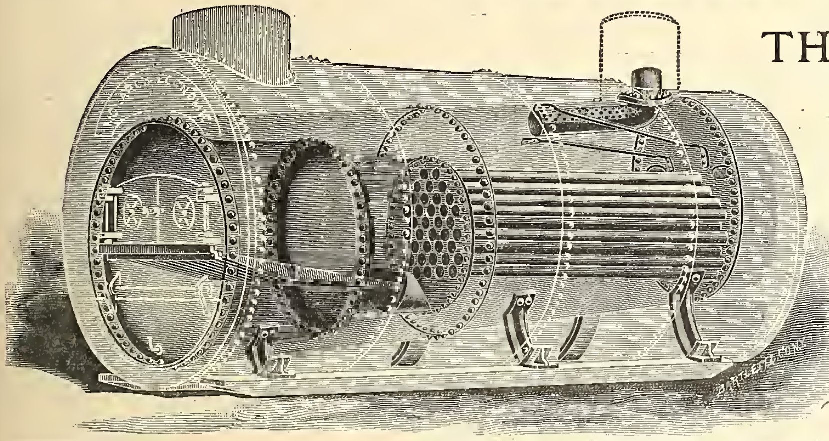

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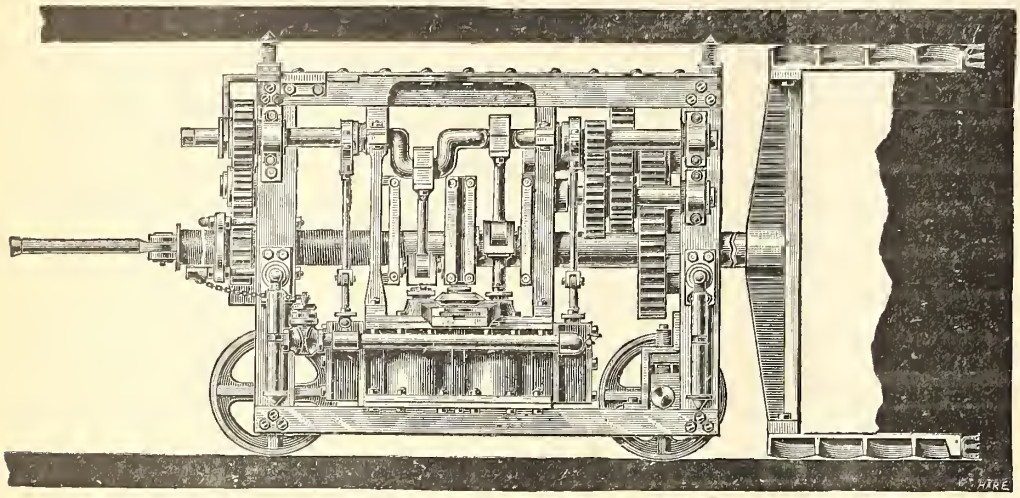

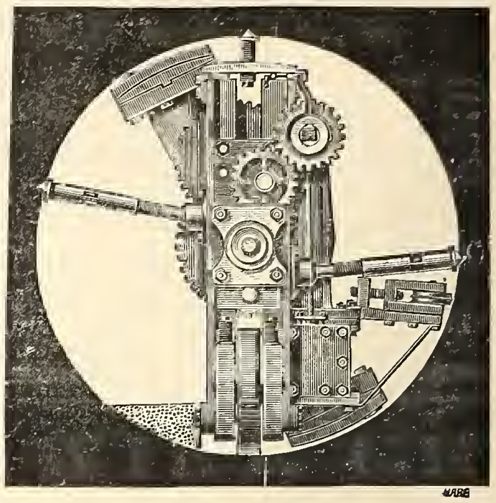

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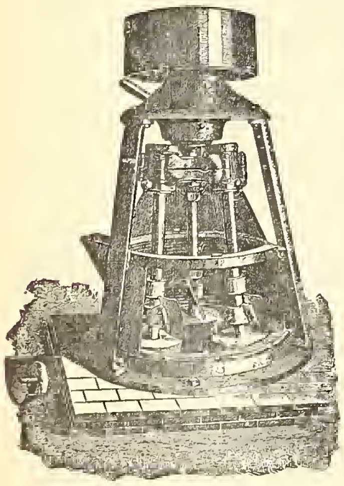

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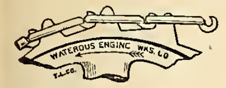

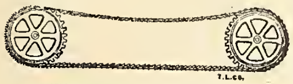

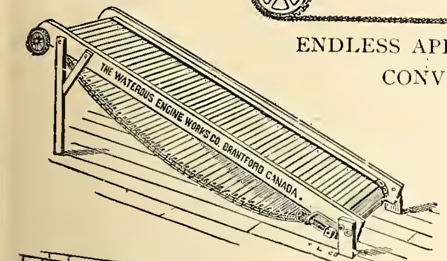
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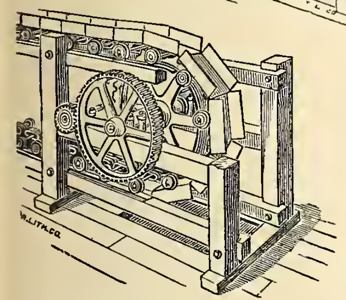

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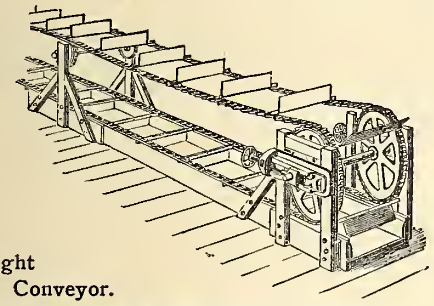

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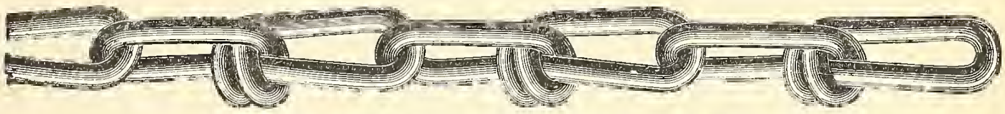

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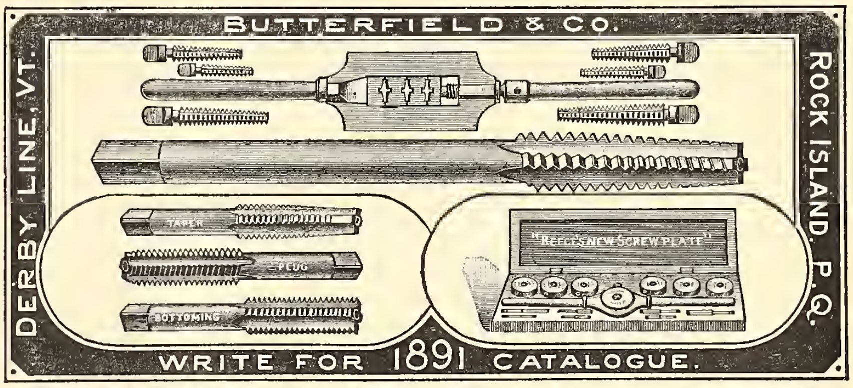
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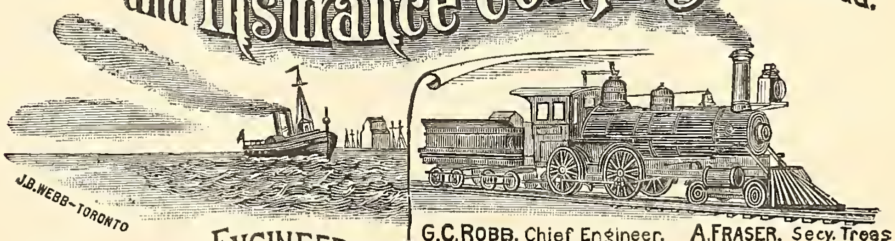

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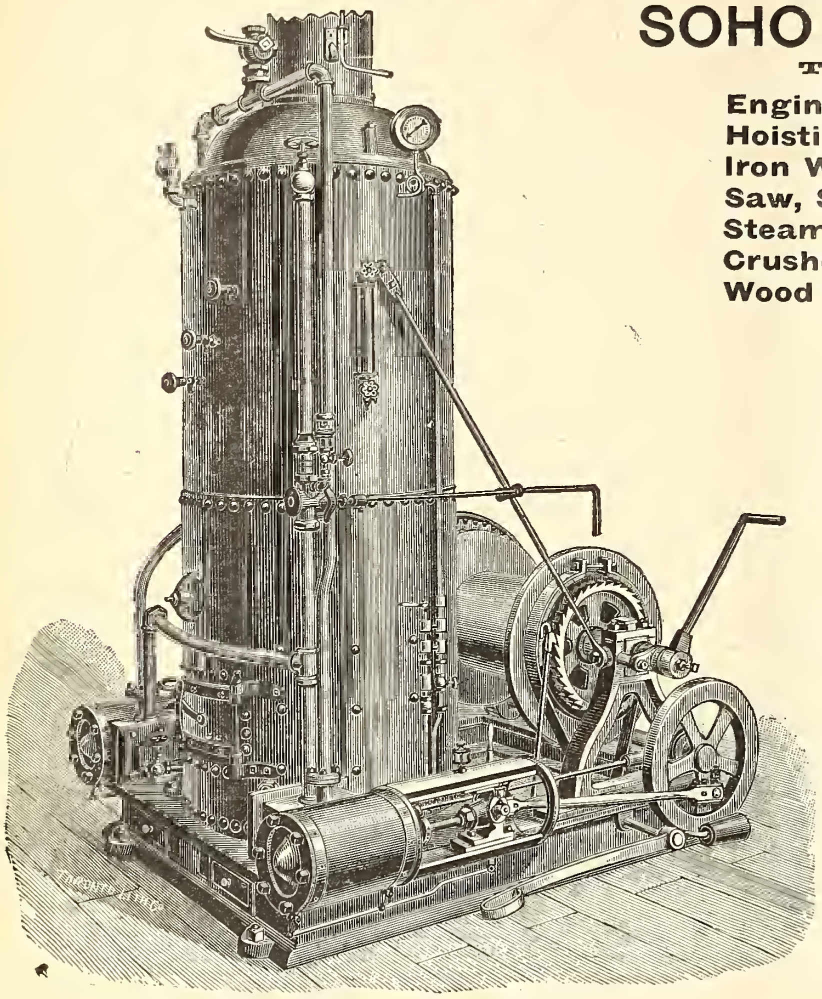

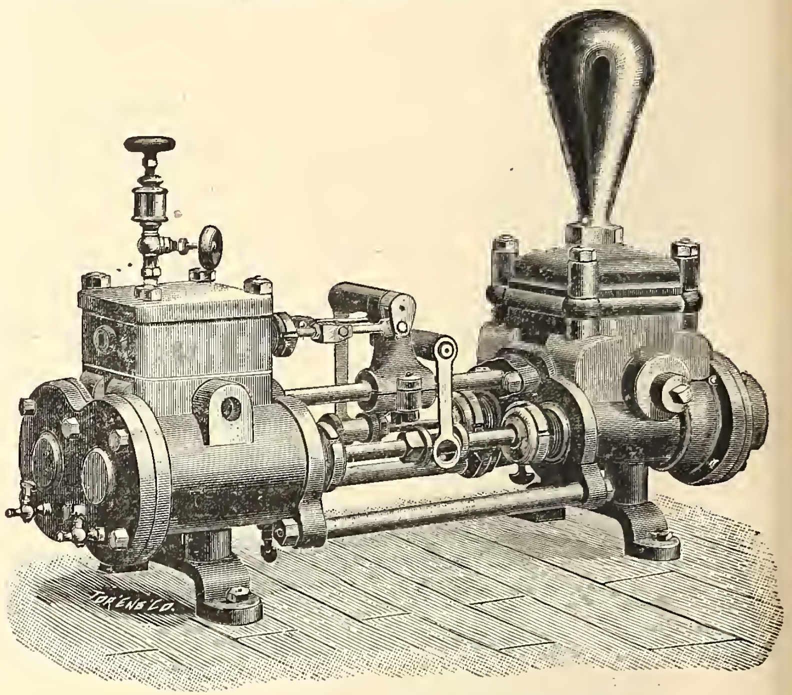

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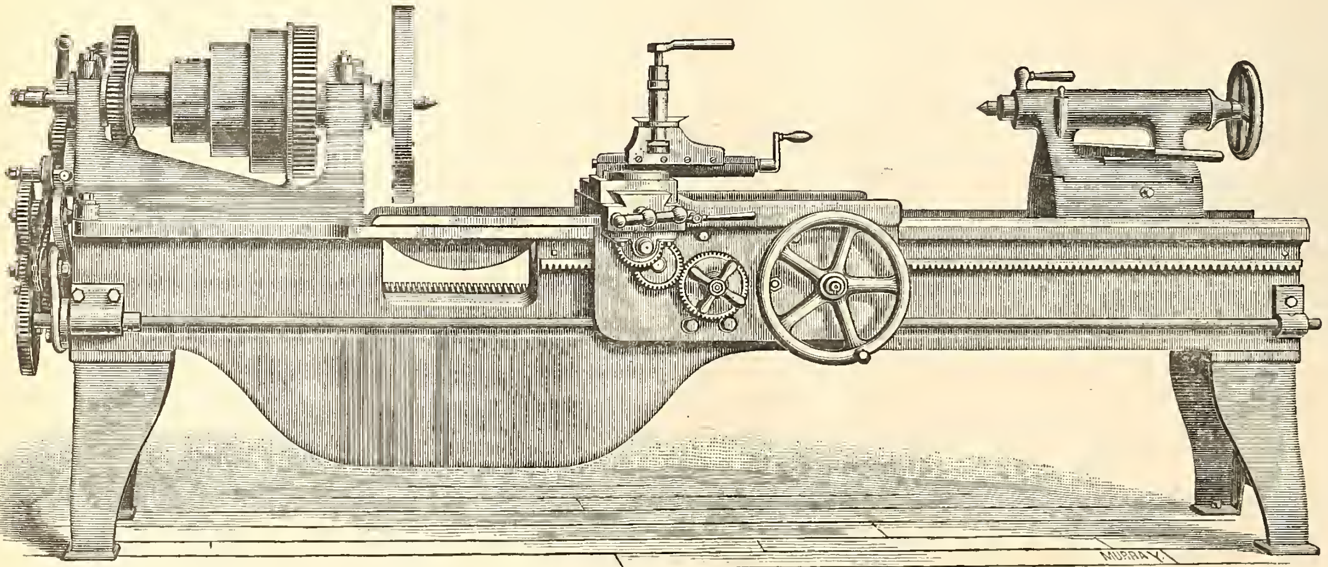

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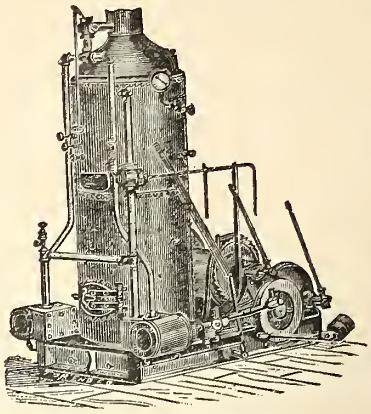

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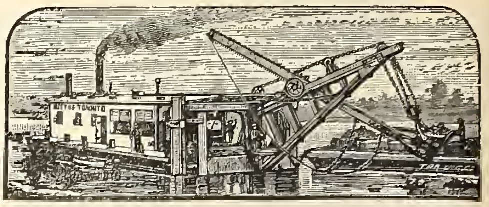
Centrifugal Pumps,



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The Ontario Government's Mining Policy.

The deliberations of the recent Mining Convention at Toronto, and the legislation on mining matters announced by the Ontario Government, indicate the growth in the popular consciousness of the idea that the provincial mineral wealth is not merely length and breadth without depth, and therefore need no longer be given, granted, and sold forever in terms of superficial acres for 100 cents each. In the absence of that knowledge of our mineral resources and the best means of exploiting them, which we should have begun to acquire nearly a quarter of a century ago, the Government policy is cause for thankfulness. It was urged in some quarters that nothing short of a Department of Mines, with a responsible Commissioner as a member of the administration at its head, are necessary to further the mineral interests of Ontario, but the Government have done well to recognize that the country lacks education more than a policy. The promise of a Mining Bureau recognizes that the educational necessity transcends the political. The Government and the country will do well to understand just what the educational necessity is. The list of disastrous enterprises in mining and metal manufacture is a long one, and the cause of their disaster, beyond all doubt, is mainly due to the lack of skilled industry and scientific direction. For remedy of the latter, how are we equipped? Vainly shall one look through the "course of study" in the Ontario School of Practical Science for mention of a working laboratory for students of mining engineering and metallurgy. In the "practical course," under the head of "mineralogy and geology," one finds: "Use of blowpipe, fee $10;" "blowpipe analysis, fee $15;" "assaying, fee $50." The first two subjects should be within the function of a science master in a country grammar school,—so called before pretentiousness substituted the title of Collegiate Institute. Compare the tariff of fees with the announcement of the "Michigan Mining School" at Houghton, Mich.: "A State school of Surveying, Mining, Electrical and Mechanical Engineering, Physics, Chemistry, Assaying, Ore Dressing, Mineralogy, Drafting, Machine Design, etc. Tuition free."

The area of the State of Massachusetts is 7,250 square miles, and her only mineral wealth some scanty deposits of bog iron ore; our Algoma District as originally constituted, between the mouth of French River and the western provincial boundary, comprises 200,000 square miles. But though we could supply territory in that district alone, for 27 States like Massachusetts, our little cousin found, some years ago, among her youth one whose priceless wit uttered a proverb worth many miles of dollar-an-acre mines. "What on earth can you raise in such a country as this anyway?" asked a wayfarer of an urchin he met in a rock-walled field in Massachusetts. "Why, we build school houses and raise men," was the noble answer. And so we find the equipment of the mining and metallurgical laboratories of the Massachusetts Institute of Technology, founded some 25 years ago, are fitted to "raise men" to a far higher attainment of useful knowledge and practical skill than anything this vast Ontario can offer. The Institute announces that these laboratories have been fitted with a view to "furnish students means for studying experimentally various processes of ore-dressing and smelting, and what is required of a miner or metallurgist. The metallurgy of lead, copper, gold, and silver has been chosen as best suited for laboratory illustration; production of iron and steel in quantity is prohibited by the size of plant requisite, and by the large amount of ores and fluxes necessary to put this into operation. The experimental work of the laboratory is carried on by students under charge of an instructor. A sufficient quantity of ore is assigned to each student, who first examines it for its component minerals, sorts and samples it, and determines its character and value by analysis and assays, and makes such other preliminary examinations as serve to indicate the proper treatment. He then treats the given quantity, makes an examination of the products at each step of the process, ascertains, where practicable, the amount of power, water, chemicals, fuel and labor expended, and thus learns approximately the effectiveness and economy of the method adopted. He learns the value of chemistry as a check upon metallurgical work. Each student is assisted in working by his classmates, each of whom has an opportunity in turn to manage the machines and furnaces.

The Institute does not claim that the laboratory is in any sense of the word a substitute for Works. What is claimed is, that it prepares students to go into Works, and to profit by them.

"The mining laboratory consists of three parts—milling room, furnace room, and assay room—with ample storage vaults, supply room, and toilet room attached.

"The milling room is supplied with four suites of milling apparatus: 1. A three-stamp battery, set of amalgamating plates, mercury-saver, Frue-vanner for concentrating tailings, settling-tank, and centrifugal pump. 2. A Blake challenge crusher, crushing-rolls with automatic sizing screens, Richards-Coggin separator, spitzkasten, two Harz-Mountain jigs, Evans table or rotary-buddle, settling tank, and centrifugal pump. 3. A set of four amalgamating-pans, 30, 18, 12 and 8 inches in diameter respectively, also 36-inch settler, and little automatic sieve for separating mercury from pulp. 4. A set of three 40-gallon leaching vessels, set of four 8-gallon leaching vessels, and two dynamos for deposition of metals. The laboratory contains the following auxiliary apparatus: A steam engine, Bogardus mill, Root blower, Sturtevant dust-fan and blower, drying tables, and four Morrell agate mortars.

"The furnace room contains a water-jacket blast furnace, a copper refining furnace, reverberatory lead-smelting or agglomerating furnace, two roasting furnaces, furnaces for cupellation, furnaces for fusion, blacksmith's forge, melting kettle, retorts, etc. The assay room contains ten crucible furnaces, 12 x 12, all of which are jacketed with iron shells to ensure good draught, stability, and durability; two muffles 4 x 7, one muffle 3 x 6, four muffles 7 x 12, one muffle 8 x 15. These furnaces are provided with ample flue capacity and abundant draught. This room contains six pulp balances, six flux balances, five button balances, and desks for fifty students.

"The Institute is from time to time receiving ores of gold, silver, lead, copper, nickel, antimony, etc., from various localities. These ores are worked, and reports sent to those who contribute them; and it is expected, that, by the co-operation of those who wish to have examinations made, the laboratory will continue to receive the necessary amount and variety of ores.

"To bring the mining students into closer acquaintance with their profession, excursions are organized for visiting mines, mills, smelting works, and geological fields. These excursions take place as often as once in two years; and, since the year 1870, excursions have been made to Colorado, Lake Superior, Virginia, Vermont, Pennsylvania, Lake Champlain, New Brunswick, and Nova Scotia. Shorter excursions of a day or two at a time are made while the school is in session."

Now it is safe to say that in view of our present need, laboratories such as above described are not only required, but inasmuch as they are confessedly "not a substitute for Works," it would redound very much to the benefit of the Province to have them extended at least to the attainment of practical work in the metallurgy of iron and steel. For the science of metallurgy reveals. Its growth is something like an organism whose function is aiding the expansion of national intelligence and advance in civilisation. It is of all modern sciences, a living thing; a daily revelation of Him who is "great in counsel and mighty in doing." We shall do well to haste to a knowledge of its operations. The industrial forces surrounding this country are moving with a stride our sparse population and commercial by-laws can do little to influence one way or other. The future of the farm and the railway, the frontier city and the manufacturing town, may depend more largely than we can see upon what we do in the next decade for the development of our mineral resources.

The operations of a Bureau of Mines are plainly necessary in the Thunder Bay and Algoma districts, and most useful surveys should here be undertaken on a scale of sufficient magnitude. Where surface indications are not sufficiently expressive, some application of the diamond drill will impart profundity to our knowledge. As the work progresses, maps should be published and the information obtained spread far and wide, so that the Province may get the benefit of the largest possible competition for leases. An assaying and milling laboratory should be established at Port Arthur, or some other central point. The Swedish Export Association, chiefly a government affair, sends its drummers to India, Spain and South America to compete with British exporters in the quest for orders for special lines of iron and steel. Can common sense find any reason against the provincial importation of a few Swedish iron-makers and charcoal-burners, for instituting here the manufacture of high class charcoal iron, a production saleable in various parts of the world in spite of hostile tariffs. The importation of Mr. Cockerill, a British iron master, by the King of Belgium, and the supply of money for his enterprise, established in that country an iron manufacturing business second to none in the world in its influence upon the industry of a nation.

Of what complexion will the Province make the Bureau of Mines? Will there be appointed to its duties, men who can give you the analysis of the bronze of Achilles' shield, an epigram on the brass in a lawyer's cheek, names for metals and alloys in every dead language, accurate delineations of the furnaces and mining tools of the mound builders and the pre-historic metallurgy of Atlantis? Or shall we have some well posted in metal tariffs and glib to point out what "We would, and if we could," if anything were otherwise than it is. Shall the annual report be a yearly contribution to provincial party politics and a factor in promoting a reputation for provincial stupidity, or shall its pages record the triumphs of science under difficulties and the progress of the people in useful arts which it is some measure of disgrace are now unknown to them? Shall we pursue a system of wrecking, and liberate to periodical attacks on capital, schemes which find no small degree of sanction in the ignorance which it is the duty of a wise Government to remove? Is it not possible to make the report of a Bureau of Mines—equipped and controlled by competent, well trained and experienced metalliferous engineers, as assuredly it should be — a guarantee upon which the enterprising miner may with reasonable certainty base his calculations? Beyond question it is, if the Government will but awake to the possibilities before them in this direction and to the need for immediate, liberally-devised measures for the development of the mineral wealth of Ontario.

The land policy of the Government is well within its own control and no doubt such should be the case for a time. There are constitutional objections to making the head of a Department the arbiter in a matter of right of purchase or lease. While our mining law is in a transition state this cannot well be otherwise. If the Government will but follow out not so much what the Mining Commission recommend as what their report suggests, we will have no cause to complain of a land policy framed to protect public interests.

The royalty proposed on ores, and the advanced price of mining lands, will hardly add anything to the revenue. A score of companies might be named who could part with 49 out of every 50 acres of their territories and still retain their mines intact. The royalty from many mines will hardly pay the cost of collection. In the case of shafts going down at great expense on lean ore, the payment of royalty will seem a hardship, and the mining director should have certain discretionary powers in the premises. In the case of iron mines, two per cent. on the value of ore at the pit's mouth will yield a return of $600 from a mine giving an output of 30,000 tons a year. It will be difficult to find a case where the best magnetic ore in Ontario is worth over $1 a ton when brought to ground. But, in fine, we are convinced that good will come out of the proposed legislation, though it may be but little; that progress will be made, though we shall hasten but slowly; and that there is much to be thankful for in the recognition given by Mr. Hardy's bill, to the fact that length and breadth, without depth—in other words, superficial area—should not furnish any longer the basis on which our mineral territory shall be sold. There is profundity in the conception which cannot but have its influence abroad for good.

The Ontario Mining Act.

We are indebted to the courtesy of the Hon. E. H. Bronson for an advance copy of the Bill to amend the General Mining Act, introduced the other day into the Ontario Legislature, a summary of the leading features of which is presented below. The changes in the law are important. The price of mining lands to the north and west of Lake Nipissing is to be raised from $2 to $5 an acre, and those to the south and east, heretofore sold at $1, will in the future be sold at $3 an acre. Power, moreover, is given to the Lieut. Governor-in-Council to set apart by regulation any territory shown to be particularly rich in minerals, and to fix the price of such lands at any greater price than those above mentioned, or they may be temporarily withdrawn from sale altogether. Purchasers of mining lands are compelled to develope their properties by a clause requiring that within ten years of the date of patent, they shall expend in actual mining operations, the equivalent of at least $3 per acre in the case of lots of 160 acres, or of $5 per acre in smaller lots, in default of which the mineral rights revert to the Crown, but the land remains the property of the purchaser. Under section seven, it is provided that instead of selling the land in fee simple, it may be leased by the Crown for ten years, with the right to renew for a further term of ten years, and thereafter for terms of twenty years on a rearrangement of the rent. If default is made by non-payment of the rent, or the breaking of any of the covenants in the lease, it is to be forfeited. All ores and minerals mined after the passing of this Act are to be subject to a royalty for the use of the Province, whether such royalty be reserved in the grant, patent, or lease, or not. Silver, nickel, or nickel and copper, are taxed 3 per cent., iron 2 per cent., and all other ores such percentages as may from time to time be imposed by Order-in-Council, in no case to exceed 3 per cent. Ores taken out by way of experiment may be made free of royalty on the recommendation of the Director of Mines. The bill provides for the appointment of a Director of Mines, who is to be under the direction of the Commissioner of Crown Lands, and who is to have charge of the mining matters of the Province, with such other powers as may be assigned to him by regulation. The Act does not apply to lands already sold, but only to those which may be disposed of hereafter.

We hope to make a more extended comment on the Bill in our next issue, but we cannot refrain from pointing out the injury that such a royalty must work to the mining interests of the Province. It is unjust inasmuch as it singles out for taxation a particular industry, and the most precarious and laborious of all productive industries. Of course, mining under skilful management is often very profitable, but at the same time it must be remembered that the list of failures is very large, and outweighs these remunerative enterprises in a general consideration. Yet the Bill practically discriminates against the unfortunate by taxing the gross product instead of profits or dividends. Such ill-considered legislation as this clause would enact, will, it is to be hoped, be withdrawn or amended before the Bill is passed.

The "gift of tongues" is, unfortunately, not one of the most prominent accomplishments of the office, as was felt the other day when a handsome card with a, to us, enigmatical inscription, came from the post. The deliberations of our large staff were immediately called into requisition, and after much debate, it was discovered—that the language was German. It might as well have been Greek, nay better, for some of the staff had had that tongue instilled into them by the gentle birch, but, with the exception of the office boy, who could swear a little in it, the Teutonic "sprache" was an unknown quantity. Sundry wild conjectures were ventured on. After numerous consultations of "Ollendorf," it was announced that the mysterious missive was nothing less than the wedding card of our friend Dr. C. Killing, of Amsterdam. It was at once unanimously voted: that the REVIEW extends its heartiest congratulations, and wishes the happy pair every good fortune. In which, we are sure, all who have had the pleasure of meeting Dr. Killing will join.

As hinted in a previous issue, the gold yield in Nova Scotia for 1890 was somewhat smaller than in 1889, a close estimate from official sources placing the quantity in the neighborhood of 23,000 ounces. During the previous year the yield amounted to 26,155 oz. 6 dwts. 13 grs, from 39,160 tons of rock crushed.

EN PASSANT.

Some time ago mention was made in these columns of the discovery of vast deposits of tar sands in the valley of the Athabaska. In his report to the Geological Survey, Mr. R. G. McConnel states that the eastern boundary of these deposits has not been precisely defined, but their outcrop is estimated to have a minimum distribution of fully 1,000 square miles. In thickness they vary from 150 to 225 feet. The tar is unequally distributed through the sands, in some places merely staining the grains, but in most of the sections examined it is present in sufficient quantity to render the whole mass more or less plastic.

The commercial value of the tar-sands themselves, as exposed at the surface, Mr. McConnel thinks is at present uncertain. But the abundance of the material, and the high percentage of bitumen which it contains, makes it probable that in the future it might be utilized for various purposes. "It proves a flow of petroleum to the surface unequalled in the world." The question of the continuity of the tar sands, and their petroliferous character under cover, can only be settled in a decided manner by boring, and Mr. McConnel is strongly of opinion that drilling operations should be undertaken for this purpose. He recommends that two bore holes, one at the mouth of the Lac la Biche River, and the other at the mouth of the Pelican, would add largely to our knowledge of the underground geology of this region, and would settle positively the question as to the presence or absence of petroleum in paying quantities. At the mouth of the Pelican River, a bore hole, in order to reach the tar sands, would require to be sunk 700 feet, and at the mouth of the Lac la Biche River about 1,200. The former locality is 50 miles distant in a straight line from the outcrop of tar sands at Boiler Rapid. The latter is 106 miles from the same point, and is only 110 miles from Edmonton.

In view of these recommendations, it is not unlikely that the Dominion Government will make some tests during the coming summer. The indications seem amply sufficient to warrant the small expenditure involved, and the advantages that would accrue to the North-West are almost incalculable.

A very interesting paper on the Florida phosphate industry, was read a short time ago by Mr. W. M. Fuller, of Wolverhampton, Eng., under the auspices of the Chemical Manure Manufacturers' Association, from which we excerpt the following pertinent paragraphs :—

> "I have been applied to by various friends for an opinion as to the safety of investing in Florida phosphate property; my advice is, be cautious what you are about, for it is not all gold that glitters. Properties have been sold at many times their value, and in some cases claims have been sold and put forward as phosphate lands upon which no phosphate exists; in other cases uninitiated persons have been misled by small pieces found on the surface, forgetting that a few swallows do not make a summer.
>
> "There have been certain parties in London, from the States, doing their best to swindle John Bull, and unless you have reliable means of ascertaining the real facts—if you are out, *keep out;* if you are *in, get out.*"

According to a return kindly furnished us by the United States Consul at Port Arthur, the Beaver Mining and Milling Company exported $30,000 of silver ore, crushed and concentrates, and the Badger Silver Mining Company, $24,000, all to the Balbach Smelting and Refining Company of Newark, N.J. These exports were for the quarter ended 31st ulto.

For the first time in the history of Canadian mining, electricity is about to be used as a motive power. The company introducing it is the New Vancouver Coal Company, at Nanaimo, B. C., who have ordered a plant, costing considerably over $50,000, for use in their mines. It will include an underground tramway with power sufficient to maintain a uniform speed of eight or nine miles an hour, with 150 loaded cars continually moving. The mines will be lighted by six hundred incandescent lights, and the drills and cutters will be operated by the same current. The necessary materials will be in place in a few weeks and will at once be put in operation. Electricity for lighting purposes is also used at the mines of the Dominion Mineral Company at Sudbury, and will shortly be introduced in the phosphate district by one of our operators.

Apropos of our comment last month on the reported sale of the Badger, Porcupine and other mines, to an Anglo-American syndicate, the following letter has been received from Mr. Walter Read, Secretary of the Badger Silver Mining Company :—

> "Our company has sold the Badger and the Porcupine mines to a syndicate, of which Mr. Herbert N. Nichols, of Denver, Col., is the representative. The amount received for the two properties was a satisfactory one—at least to a majority of the stockholders. Our company did not own the West End mine."

At last some one who has had sense enough to discern the true inwardness, and courage to speak his opinion of that ridiculous document, the "Report of the Experts to the United States Government on the Sudbury Nickel Deposits," has come forward. Dr. A. S. Thompson has, in a letter to the press, scored it most severely, and has exposed its utter absurdity, but an explanatory word as to its authenticity will be of interest. When first the nickel-crazy press in Toronto began quoting copious extracts from this new gospel of the Sudbury district, we wrote to the Superintendent of Naval Construction at Washington asking if such a report had been issued, and if so to furnish us with a copy *verbatim.* In reply we were assured that the Government had made *no such report*, and we were referred to the Canadian Copper Company at Cleveland, to whom our readers are indebted for the document. We did not comment on the report at the time other than to point out its flagrant unfairness to the other companies, for we thought that most of our readers had enough sense to appreciate at their true value the statements of a number of gentlemen who might be authorities on the construction or navigation of a ship, but who had no claim to be considered experts on the value or extent of mineral deposits.

A suggestion worth consideration was contained in a paper on "The Education of Engineers," read before the Yorkshire (Eng.) College Engineering Society. Referring to the old method of education, the putting of a quantity of practical work upon good material, and the newer system, of preliminary theoretical training followed by the practical one, it was held that the latter proves anything but satisfactory. Although it might produce some better engineers than the old plan, the average quality of the result was diminished by the number of students who were put through an entire college course, regardless of the fact that they were not of the material required to make engineers. Would it not be better, it was asked, to reverse the operation? First, to send young men to the works, where those quite unsuited to engineering would be discovered very quickly; then hand those who, so to speak, had been through the furnace, over to the college, where they would have every chance of being made creditable engineers.

While in New York the other day, we learned from a conversation with Dr. Rossiter W. Raymond, the Secretary, that the American Institute of Mining Engineers was at present looking about for a suitable meeting place for its next session in June. Dr. Raymond thought well of a suggestion to pay another visit to Canada, with Toronto as a possible rendezvous from which visits could be made to the mining districts of Algoma, Sudbury, Hastings Co. and elsewhere in the Province of Ontario. We immediately placed this suggestion in the hands of Mr. Hamilton Merritt, Chairman of the recent Toronto Convention, and he writes to say that an endeavor is being made to carry the arrangement into effect. In view of the immense practical benefits to the Province that would surely ensue from a visit of such an eminent body of trained engineers, there should be no difficulty in raising a sum sufficiently large to make this meeting a success. In 1889, the Ontario Government voted $1,000 to the Ottawa meeting, but owing to the inclemency of the weather, which limited the excursions in Ontario to a hasty run to Sudbury, only a small portion of the amount was utilized, and nearly $700 were returned. The Ottawa meeting of the Institute did much to stimulate mineral development in the Province of Quebec, and in one instance, at least, we can point to the establishment of a large factory for the manufacture of mining machinery, created directly and entirely through the knowledge of our resources gained by the visit. We hope to be able to record in our next issue that the Toronto meeting of the American Institute of Mining Engineers has been definitely settled. The Institute have held meetings in Halifax in 1885, and in Ottawa in 1889.

The mineral exports to the United States from the Ottawa Valley, for Quarter ended 31st ult., have been as follows :—

Phosphates....	300 tons, to Chicago.
Mica.........	$2,000, to Lynn, Mass.
Mica..........	$2,570.60, to Schenectady, N.Y.
Iron Ore......	1,626$\frac{7}{224}$ tons, to Catasaqua, Pa.

Dr. A. R. C. Selwyn, Director of the Geological Survey of Canada, has gone to Southern Manitoba to report on the boring operations for a good supply of artesian water at Deloraine. The total expenditure on this work has been $8,648.62. This has been derived and paid to the Deloraine Well Finance Committee, who had charge of the boring, as follows:—

Raised by Municipal loan, grant from the Local Government, and by subscription.	$4,482.78
From Geological Survey appropriation, 1889-90..........................	500.00
From special appropriation of $2,000 voted by Parliament in 1890.	1,997.54
From special appropriation of $10,000 voted by Parliament in 1891..........	1,668.30
	$8,648.62

Although a supply of water of fair quality was struck at a depth of 1,570 feet, the well is still incomplete, and it is impossible to state what further amount will be required to complete it, but Dr. Selwyn hopes that the cost in 1891 will not exceed an additional sum of $2,000.

The Nickel-Steel Syndicate, about which there was some talk during the visit of the Iron and Steel Institute to this country, has materialized, with Sir James Kitson, President of the Institute, as chairman, and Mr. F. Rey, 147 Leadenhall street, as managing director. Among the other English directors are Mr. Percy Gilchrist, well known in the metallurgical world as the co-inventor of the Thomas-Gilchrist basic process, and Sir Lowthian Bell, Bart. All the French, American and English patents, says the *Ironmonger*, have been acquired by the syndicate, the principal patentee being Mr. J. F. Hall, Sheffield. It is contemplated to reduce the cost of nickel very considerably in a form suitable to apply to steel making without in any way interfering with the ordinary nickel of commerce as now used for plating and other manufactures. It is expected that before very long works will be opened by the syndicate in the neighborhood of Sheffield, for the manufacture of ferro-nickel. This should be good news to our nickel miners, for whom there is unquestionably, in the near future, an era of great industrial activity in the production of their ores for the manufacture of nickel-steel.

The *Mining Journal* is authority for an amusing story of the late P. T. Barnum, in which he figures as a mine exploiter of the wiliest type. It was in 1849, the year of the California gold excitement that the incident occurred. Mr. Barnum arrived in New York with the first specimens of Californian gold. The gold-fever was at its height; thousands were preparing to leave for the new Eldorado, and he cast about him to turn it to some account. Going to Mr. Gillman, of Boston, Mr. Barnum proposed that he should give a series of lectures on the subject in great public halls. Of course a fine nugget would be needed by way of illustration. Mr. Barnum had, as he said "a specimen lump" already prepared and weighing 25 ounces; but unfortunately, Mr. Gillman had never seen or heard of a "lump" that weighed more than seven ounces; but seven ounces would never do. "Why sir!" exclaimed Mr. Barnum, "every man who is going out expects to pick up rocks of it." A compromise, however, soon suggested itself. "Well, sir, said the resourceful showman, "I tell you what we can do. You prepare a short lecture on the subject, to be delivered in my lecture room—not over fifteen minutes long, better ten—and then be prepared to answer questions (they'll be sure to come thick and fast) about the different routes, the mining, means, and cost of living; just how to do it you understand. We will have a small table on the stage, with my twenty-five ounce lump of gold on it. As you are talking, you can handle it; just pass your hand over it now and then—and—and—I wouldn't have you tell a lie about it for anything, Mr. Gillman—but if—you see—they get the idea that that's the kind of lump they *may* find, a fortune's made and we'll share it." We cannot help thinking what a noble partner the late Mr. Barnum would have made for that disinterested patriot on both sides of the line, Mr S. J. Ritchie, in the Sudbury-boom business.

The Springhill Relief Fund has been steadily growing until now it is very little short of $75,000. From every part of the Dominion large contributions have been received, and considerable sums have also been raised in England and the United States. There has been some little trouble over the administration of the fund. Certain citizens of Springhill, conceiving that it was not being devoted altogether to its proper purposes, held a meeting a short time ago, and in round terms, denounced the conduct of the Committee. Their action seems to have been entirely uncalled for; the money has been lodged in the Bank of Montreal in the name of four trustees whose probity does not admit of doubt, Hon. George Drummond, Sir Donald A. Smith, E. S. Clouston and Robert Cowans, and Hon. James McDonald, Chief Justice of Nova Scotia, has been asked to become a fifth. This alone should guarantee the proper administration of the fund, while at the same time every confidence is to be placed in the Committee. The mayor of Springhill immediately called a meeting of the Council, at which the following resolution was passed:—

"Whereas, it has come to the knowledge of this Council that rumors are abroad reflecting on the honesty, integrity and judgment of the Committee having control of the Springhill Relief Fund, that may tend to awaken in the minds of people who have generously contributed a feeling of regret in fear lest the persons for whom their sympathies were awakened should not receive the full benefit of their gifts. Therefore, resolved:—

"1st. That we place on record a motion of confidence in the persons comprising the Relief Committee, viz.: Alexander McInnes, mine manager; William Conway, underground manager; Andrew Scott, underground manager; Abner McLean, miner; Robert O'Rourke, miner; J. G. Aikman, Superintendent of the S. H. & P. Ry., and A. E. Fraser, late mayor, as an assurance to a generous public of the honesty and ability of these gentlemen to manage the relief fund in the best interests of the bereaved by the late mining accident.

"2nd. That we approve of their action in having placed a portion of the funds in the Bank of Montreal in the names of the Hon. G. Drummond, Sir D. A. Smith, E. S. Clouston and Robt. Cowans, as trustees, men of national reputation.

"3rd. That in the name of the citizens of Springhill, we tender our sincere thanks to the people throughout the length and breadth of Canada, the United States and Great Britain, who have so nobly responded to our appeal for assistance, in our sore calamity.

"4th. That the clerk at once communicate a copy of these resolutions to the Halifax and St. John papers.—Passed. "WM. HALL, Mayor."

"SPRINGHILL, April 3, 1891."

In the light of last summer's excitement over reported rich finds of gold in the conglomerates at Gay's River and elsewhere, the following remarks by Mr. Hugh Fletcher, of the Geological Survey, will be of interest to the gold miners of Nova Scotia: "The region was proclaimed a gold district and rights of search taken out covering many miles. The attention of prospectors was, moreover, directed to all the conglomerates in the province. That the conglomerate of Gay's River is auriferous has long been well known, and Professor Hind has proved the existence of gold, silver and copper in certain beds of that nature near Baddeck. The Brookfield conglomerate was said to have given rich returns by milling, although a somewhat close examination by panning the dirt in the beds of the streams flowing over it failed to indicate the presence of gold in appreciable quantity. Two samples were sent to Mr. Hoffmann, one from the neighborhood of the barytes mine, the other from the brook three hundred yards above the Glenbervie mills; but neither of them yielded, on assay, a trace of either silver or gold. Tests subsequently made on a large scale at the mill of one of the gold mines emphatically confirmed the accuracy of Mr. Hoffmann's assays."

The arrangements for the First Quarterly General Meeting of the General Mining Association of the Province of Quebec being now complete, we are able to give our readers the programme of the proceedings. Two sessions for the reading and discussion of papers will be held, in the Windsor Hotel, Montreal, commencing at 10 a.m. and two in the afternoon. The following subjects will be taken up:—

(*a*)—REPORT OF THE COUNCIL ON THE NEW QUEBEC MINING ACT.

By the President.

(*b*)—NOTE ON THE QUEBEC MINING ACT.

By Dr. Rossiter W. Raymond, M.E., New York.

(*c*)—NOTE ON THE LAW RESPECTING POWDER MAGAZINES IN THE PROVINCE OF QUEBEC.

By Hon. George Irvine, Q.C., Quebec.

(*d*)—MINE INSPECTION.

By J. Burley Smith, M.E., Glenalmond, Que.

(*e*)—THE RESPONSIBILITIES OF THE MINE MANAGER.

By A. M. Evans, M.E., Black Lake, Que.

(*f*)—SCIENTIFIC ENQUIRY IN ITS RELATION TO MINING.

By R. W. Ells, Ottawa, Ont.

(*g*)—THE CHEMICAL ANALYSES OF ASBESTOS.

By Dr. J. T. Donald, Montreal.

(*h*)—THE APPLICATION OF ELECTRICITY TO MINING.

This paper will be demonstrated by representatives of the Edison Co., New York, and the Thomson-Houston Electric Co., of Boston.

The meetings and all discussions are open to the public. In the evening of the same day (the 29th April), the members and their friends will dine at the Windsor. We understand that a number of prominent speakers have promised to be present and will take part in the proceedings.

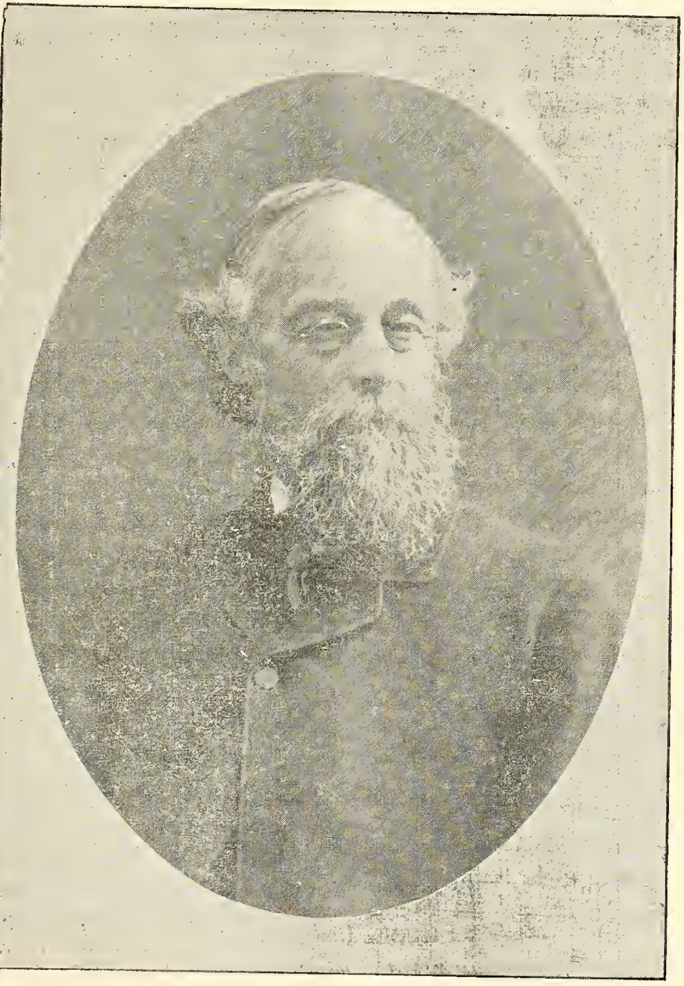
Our Portrait Gallery.

[A series of portraits and biographical sketches of Canadian mining engineers, mine managers, inspectors, geologists, explorers, etc.]

No. 11.

Alfred Richard Cecil Selwyn, C. M. G., L L. D., F. R. S.

Alfred Richard Cecil Selwyn, C.M.G., LL.D., Director of the Geological and Natural History Survey of Canada, was born in Somersetshire, England, in 1824. He is the youngest son of the Reverend Townshend Selwyn, Canon of Gloucester Cathedral. His mother was the daughter of Lord George Murray, Bishop of St. Davids, and grand-daughter of John, fourth Duke of Athol. His early education was received from a tutor, at home, but later he was sent to Switzerland, where he completed his studies. After leaving school, some years were spent, partly in travel in Belgium, France, Switzerland and the Tyrol, and partly in the position of a clerk in mercantile houses in London and Liverpool. This latter occupation, however, was distasteful, and having already acquired considerable knowledge of geology as an amateur, Mr. Selwyn gladly availed himself of an appointment as Assistant Geologist on the Geological Survey of Great Britain. The ability he displayed in this position soon attracted the notice of distinguished geologists, and in 1852, on the recommendation of Sir H. T. De La Beche, the Director of the Survey, Mr. Selwyn was appointed by the Secretary of State for the Colonies to undertake the geological survey of the colony of Victoria, Australia. About this time, much interest had been aroused respecting the gold fields and coal beds in Tasmania, and the Government of that colony decided to obtain the services of a practical geologist to decide the question. Mr. Selwyn was asked to undertake the work, and consenting, at once began a thorough and systematic examination of Tasmania, his report on which was highly satisfactory. In 1859 he undertook with equal success, a similar service for the Government of South Australia. Previous to this, in 1856, he was appointed one of the commissioners of mines for Victoria; in 1858 he was made a member of the Science and Prospecting Board, and in 1861 appointed a commissioner for the Victoria International Exhibition. The esteem in which Dr. Selwyn was held by the Government and people of the colony is best shown by these and other distinctions accorded him. He was a member of the Government Tender Board, and of the councils of the Board of Agriculture, of the Royal Society, and of the Acclimatization Society. In 1869, Sir William Logan having resigned, the position of Director of the Geological Survey of Canada was offered to Dr. Selwyn, and he accepted. His work since then is well known; the lines laid down by his predecessor have been carried out to a large extent, but the field has so greatly enlarged that the present system may fairly be said to have originated with Dr. Selwyn. The responsibilities of such a position are very great, and his task has been rendered more arduous by the small sums for a long time appropriated by Parliament for the purposes of the Survey. A regrettable dissension also at one time greatly added to the difficulties of his position; and this, together with certain ill-advised criticisms made either in malice or ignorance, which had appeared, caused the appointment of a Royal Commission in 1884 to enquire into the system and work of the Survey, the report of which silenced these complaints. Very mistaken ideas as to the objects and functions of the Institution had been, and are still held. The Geological Survey is carried on in the interests of science more than of commerce. It never was intended that it should be a sort of National Prospecting Agency, for the purpose of discovering and appraising mineral deposits, and collecting commercial statistics, though this latter feature has been introduced and is carried out to a certain extent, but rather that by it the geological structure of the country should be mapped out, thus indicating to the prospector the general areas in which he might reasonably expect to find the mineral he sought.



Alfred R. C. Selwyn

Whilst administering the details of the Survey and Museum, Dr. Selwyn has taken an active part in the work of exploration. Amongst the most important of his expeditions have been :—in 1871, from Victoria, B.C., to the Rocky Mountains by the North Thompson and Frazer Rivers; in 1872, a canoe voyage from Port Arthur to Winnipeg; in 1873, from Winnipeg across the plains to the Rocky Mountains, returning by the Saskatchewan River and Lake Winnipeg; in 1875, from Victoria, B.C., to Peace River and return; in 1882, a boat voyage from Port Arthur around the whole northern shores of Lake Superior to Sault Ste. Marie. Besides these long and arduous explorations, Dr. Selwyn has made many journeys and geological observations over large portions of every province of the Dominion, and as the foregoing record shows, he has been actively and continuously engaged in geological work for forty-seven years.

Dr. Selwyn has, as Director of Geological Surveys on behalf of the Government of Victoria, Australia, and later of the Dominion, taken a prominent and active part in the collection and preparation of the mineral exhibits at six International Exhibitions: Melbourne-Dublin, 1854-5; Melbourne-London, 1861-2; Melbourne-Paris, 1866-7; Philadelphia, 1876; Paris, 1878; London, 1886. From all these exhibitions he has been awarded gold, silver and bronze medals and diplomas. At the Paris Exhibition in 1878 he was elected Chairman of the Jury on Cartography, and was awarded the Cross of the Legion of Honor, and in London in 1886, that of the Order of St. Michael and St. George.

Since 1869 he has edited and contributed to sixteen volumes of reports with numerous maps and illustrations relating to the structural geology and to the mineral, vegetable and animal resources of the Dominion. He is also the author of the Canadian part of Stamford's "Compendium of Geology and Travel—North America," London, 1883. In 1881-2 he superintended the removal of the Geological Museum from Montreal, and its reorganization on a broader basis in Ottawa, where it now embraces natural history as well as mineralogy and geology, and has become the most complete existing collection illustrating the natural resources of Canada.

Nor is it only on the other side of the Atlantic that Dr. Selwyn's abilities have met their just appreciation. Both in the United States and Canada his work is held in high esteem. A leading scientist in New York has said of the maps published by the Director, that they are "truly magnificent; my highest expectations are more than realized in them; they are, indeed, models of method and precision, and the most noble monuments to their originator." Another gentleman in a high position in the Lower Provinces, says :—

"It is my unbounded appreciation of what has hitherto been done by the corps of the Geological Survey, under the directorship of an able and eminent chief, of whom Canada may well feel proud, which prompts me to suggest, and impels me to advocate the expenditure of a few tenths of a cent more apiece, to enable the Survey to continue recording and establishing in the most satisfactory manner, work that is being well done, and which ensures the industrial development of the country, while it will be at the same time a source of honest national pride when we compare our record with that of other countries." Many other encomiums might be cited, did space permit, but sufficient has been said to show that Dr. Selwyn's worth is widely known and honoured in the scientific world.

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CORRESPONDENCE.

An Ontario Department of Mines.

SIR: One of the most imperative needs of the Province of Ontario at the present time is for the establishment of a Department of Mines and Minerals, with a responsible head as Minister of Mines, to which the technicalities of their working could be at all times referred. James Conmee, Esq., the energetic and pushing member for Algoma, has for some time past given the subject his serious consideration, and is now actively engaged in calling the attention of the Government, through a circular, to the necessity of a technical education for explorers, prospectors, and miners generally, defining the policy to be pursued, and urging the establishment of a Department of Mines at as early a period as practicable.

At present, the limits are purchased from the Crown Lands Department, but as the timber is removed and the mines developed or worked, they are changed and put under the supervision of the Minister of Agriculture, the head of a department whose interests and practices are entirely foreign to the demand of the miners, and who personally, or his staff, are unacquainted with either the technical or practical working of the mines or the development and determination as to values of the minerals discovered.

A period in the history of the mining industry has been reached which demands a more active course and better means of advancing this important branch of the public service, whilst the immense interests involved, and the growing importance of the industry, make it imperative that a well defined policy should be adopted at the earliest period to encourage the prospecting, locating, and the various methods pursued in advancing the interests of the mining industry.

From the report of the Mining Commission lately circulated, it can readily be seen what a great future there is for Ontario as a mining district if the vast extent and variety of her minerals are developed as they should be. It is the prevailing opinion that by the establishment of a Department of Mines, presided over by a responsible Minister of Mines, the requirements of the public will be fully met and their interest properly served. Each year that action is delayed in the matter, the mining interests suffer a set back of at least ten years, and in the meantime the schools for the propagation of mining knowledge are on the increase in the United States, and are turning out pupils who readily take advantage of the apathy or ignorance displayed by those who advocate the development of the mines of our Province, and whose products must compete with those of other countries in the markets of the world.

A Bureau of Mines will in the end undoubtedly cost as much as a properly organized Department, and for the first few years of development will not render the amount one-tenth of the service, but will certainly in time become one of the best paying Departments in the province, for nearly 100,000,000 acres are mineral lands, which equal in area the agricultural lands, and exceed the mineral lands of England, Germany, France and Austria, four of the greatest nations of Europe; therefore, this, the greatest of our natural sources of wealth, deserves the prominence and attention its importance demands. Before we may count on prosperity in mining in this province, the industry must be placed upon as sound and as safe a basis for the investment of capital as that afforded by other operations of a developing character. The experience of other countries show that this can be accomplished without difficulty under judicious and proper guidance. With us the practice is at present to regard mining as a mere matter of speculation, and this opinion so retards the progress of mining interests that it has become injurious to the development of the province as a mining section. The regulating of the industry and putting it upon a basis of permanency and stability, would be one of the duties and functions of the Department; and further, to secure to those who labor and invest their capital, facilities for the redress of their grievances, and afford means of reaching the ear of the Government through a representative in the Cabinet familiar with their needs and in sympathy with their aspirations. No one acquainted with mining operations as they are carried on in this country, can for a moment doubt but that many of the failures that have occurred have been occasioned from the want of skilled knowledge on the part of those having charge of the undertakings. Both skill and experience are necessary to carry on successfully the mining industry; and in the methods of extracting minerals from their ores a technical knowledge of much higher order is required than is necessary to succeed in some of the other branches of industry. The means of acquainting our young men and our mining communities with the latest results of scientific research that would be beneficial to the industry, should be afforded, through a thorough course of instruction in mining, engineering and metallurgy, and the policy should be to reach the mining community and the young men of the Province, by affording them an elementary and practical acquaintance with a few of the branches relating to minerals and mines that will be of use to them in their daily occupations, and through them to the country at large. Two conditions are absolutely necessary, if we design to advance as a mineral producing country. First, we must increase the number of our citizens who can become practical managers and operators of mines, as well as practical miners and metallurgists; and secondly, to induce both home and foreign capital to invest more freely in mining in our Province. In order to bring about this most desirable result, the first and more important step is the establishment of a Department of Mines, and the appointment of an energetic Minister of Mines, in touch with such service. Were this accomplished, the machinery necessary to secure the end would doubtless be speedily set in motion and a great field for future attainment opened up to our young men. The question of technical education and practical training of students in the various branches of mining and metallurgy cannot long be overlooked, and shortly must be dealt with by the Legislature. The suggestion is made that a feasible plan would be to increase the facilities of the school of practical science at Toronto in order to afford a thorough course of instruction in mining engineering and metallurgy. It should be carried out, but the knowledge imparted by a single institution remote from the mining districts will not answer the requirements or properly serve the exigencies of the mining interests. The practical training would be missing, and of a necessity the studies would be confined to theory and laboratory work, whilst the course would occupy from three to five years, and would not afford the observation and exercise in the field and in the mine so necessary to success, whilst but few in number could even take advantage of such a course. Something more practical and speedy in its results is required which can be taken advantage of by the mining communities and students generally throughout the Province.

The mining schools of New Zealand seem well adapted to our wants. In that country a school is established in each range or mining district and visited by a university professor and a qualified staff of assistants, who not only deliver lectures on such topics, but also conduct the practical training of classes in the various scientific courses that are of the most practical utility to those engaged in mining. In such schools the miner and the student, having the advantage of being surrounded by practical mining operations, and daily brought into contact with them, acquire in a few months a sufficient knowledge of the most essential branches of science relating to minerals such as are most calculated to assist them in their daily work, and thus a great mass of people are enlightened as to methods to be pursued that never would be reached by a central institution only; and unless some such opportunities as these are afforded our young men, they will go elsewhere to attain them, and few, if any, will return. It is as necessary to train the mining student in the vicinity of the mines as it is to train the medical student in the vicinity of large hospitals, or the law student in the atmosphere of the courts. The great advantages of the system just referred to, where the schools are dispersed through the mining districts, are that they afford facilities for experiments. Each mining range carries with it local conditions peculiar to itself, and the miner who depends upon theoretical knowledge only may, and often does, find himself confronted with a state of things for which he is not provided, and which may be the very reverse of all the theory that he has taken so much pains to acquire. A man well qualified to deal with a certain mining range may find himself at a loss with another not more than ten miles away. General principles may apply in all cases, but local conditions must also be considered and provided for. Schools on the New Zealand plan would afford practical experiments in each locality where mining is at all advanced. The aim of these schools would be to train the hand to execute as well as the mind to discover and design. As to the utility of the system quoted, Professor Black reports the following to the Minister of Mines for that colony. With reference to the facility with which the miners master the subjects, and the short space of time in which skilled operations are overcome and acquired by those whose hands have been practically trained in mechanical work, the professor says: "I was never so impressed as I was one night at Karangahake with the intelligence, perseverance and energy which the miners can bring to bear upon any subject in which they are intensely interested. Here we had many of them analyzing and assaying silver ore with quite sufficient accuracy by the usual laboratory and furnace process, while three days before very few of them could identify silver ore when they saw it, much less could they form an idea of the portion of silver which it contained." One of the chief functions of the School of Mines would be to investigate the character and composition of gold and silver-bearing quartz and other valuable minerals, to procure the most recent information concerning their treatment elsewhere, and to guide the miner in the application of sound and scientific principles in both mining and metallurgy. Thus there would be practical experiments directed by skill and experience carried on in each mining locality, whilst the useless expenditure of capital and energy in hopeless directions, now so frequent and so injurious to the mining development of the province, would be obviated, and the country would be in a better position to profit by whatever mineral wealth our lands contain. In Europe scientific attention, directed by government authority and supported by the public purse, has long been engaged with improvements for raising and the treatment of ores, and it is by such aids that the mining industries of the European powers have been built up.

"MAC."

TORONTO, April 1, 1891.

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Gold on Cayoosh Creek.

BY DR. G. M. DAWSON, OTTAWA.

Cayoosh Creek rises among the high and rugged mountains of the eastern border of the Coast Ranges of British Columbia, and flows into the Fraser near the town of Lillooet. Rich gold placers were worked along this part of the Fraser more than thirty years ago and still continue to produce some gold, but singularly enough, though thousands of experienced miners have passed Cayoosh Creek on their way to Cariboo and other inland points, it was not known to afford payable ground till 1886. The discovery was then made by Chinese, and these people, almost exclusively, have since worked the Creek for a length of two or three miles, extracting therefrom several hundred thousand dollars worth of gold. Subsequent to this discovery auriferous quartz veins were found on the upper part of the Creek, about seven miles from its mouth, and a number of claims were taken up by white men, of which the first and best known was named "The Bonanza." The occurrence of visible and free gold in these quartz veins, at once gave a clue to the origin of the placer gold of the creek bed and its adjacent terraces. Assays of the quartz made in the laboratory of the Survey, showed gold varying in amount 0·722 oz. to 0·992 oz. to the ton, the gold being very minutely and uniformly distributed through the rock. Prospecting has since been carried on upon these veins but no persistent attempt has been made to work them, but the discovery within the last few weeks of an exceedingly rich, though small body of quartz on the Bonanza claim, will no doubt lead to the business-like opening up of these promising deposits. I am indebted to Mr. F. Soues, Gold Commissioner, and Messrs. Bell and Harvey for a specimen of the quartz lately found, which is said to assay at the rate of 9,000 ounces to the ton. Conformably with the character of the quartz previously known here, the gold, though forming so considerable a part of the whole of this specimen, is thickly spangled through the rock in separate granules, such as to produce "scale gold" if the whole were comminuted and carried into the gravels of a stream.

In 1889 I visited and examined the places in which prospecting was in progress on the "Bonanza," but understand that the present find has been made at a greater height above the stream, on the mountain side, than that to which the veins had then been followed. None of the quartz veins when I saw them were large, most of them being about six inches only in thickness, and the largest not exceeding a width of 2 feet 6 inches. The veins and stringers were, however, rather numerous, characterizing a belt of some width and running for the most part parallel to the bedding of the dark argillaceous shales or schists in which they are contained. The steep character of the mountain slopes in which the veins occur in this locality appear to afford facilities for obtaining considerable quantities of quartz from these small veins at a moderate expense, and if seams or kernels of the character of that just discovered should be found to occur even at considerable intervals, the profitable working of the whole belt of veins and stringers may be assured. The rocks containing these veins form a zone included between the grey granitic and gneissic rocks characteristic of the Coast Ranges and belong to the series seen along the line of the Canadian Pacific Railway near North Bend and elsewhere on the Fraser River. The present discovery thus goes far to prove the accuracy of the suggestions made in my "Mineral Wealth of British Columbia," with reference to the connection of the placer gold of this part of the Fraser with the run of these rocks. It should also afford encouragement to the further prospecting of rocks of this age and character in the various parts of the Coast Range region in which they occur.

In conclusion the statement just alluded to may be quoted as follows: "On comparing the portions of the Fraser River thus found to yield 'coarse' gold with the rock formations of the country, it is found that the first described run of 'coarse' gold corresponds almost exactly with that portion of the valley which is excavated in certain schistose argillites and micaceous and other schists of dark colour, to which the name Anderson River Series has been provisionally assigned. It must, however, further be remarked that a series of Cretaceous argillites, conglomerates and sandstones which have probably been deposited in a still earlier hollow excavated along the outcrop of the soft rocks of the Anderson River Series, also runs parallel to this part of the river, on its east side; and that while it is probable that the gold has originally been derived from the Anderson River series, a portion of that now found in the river may have been obtained by the robbing of Cretaceous placers contained in these later rocks."

For further particulars bearing on the general question, I may refer to the work already named, particularly to pages 28 R., 47 R. and 118 R.

The Ontario Mining Laws.—Important Recommendations by the Port Arthur Board of Trade.

To the Members of the Board of Trade of the Town of Port Arthur:

GENTLEMEN,—In pursuance of a resolution of the Council of your Board, passed on 24th ult., appointing a Special Committee, composed of the officers and thirteen members of the Board, to investigate and report upon the necessary or proposed changes in the Provincial Mining Laws, the committee begs to report as follows :—

WORK OF COMMITTEE.

1. That the meeting of the Committee was called for Monday, the 26th ult., at the Secretary's office, at which there was a large attendance of the members. The Committee was then organized by the appointment of a permanent chairman, held daily meetings up to Feb. 4th, and discussed at length the proposals made. The Committee had not only the benefit of the advice of the practical mining men who were of their number, but also were able to profit by the suggestions of several well known explorers and others interested in the district, who were good enough to attend many of the meetings, and the conclusions arrived at may be taken as the unanimous wish of those interested in both exploring and mining in this district.

The Committee deemed it advisable that the recommendations made should be followed by brief statements giving the reasons for the conclusions arrived at in order that other representative bodies, when discussing the subject, might the more readily understand the position taken by your Board.

A DEPARTMENT OF MINES FOR ONTARIO.

2. That it is of the utmost importance that there should be established a Provincial Department of Mines, to be presided over by a responsible Minister of the Crown, similar to the present Department of Crown Lands.

It was the unanimous decision of the Committee that such an important industry as mining deserved more care and attention than it was possible to get from the Government when it was not under the charge of a Minister and Deputy, whose business it would be to promote by every legitimate means the development of the mineral resources of this great province. With the creation of a Department, problems that are now difficult of solution would be easily solved, and there would be some incentive to the building up in Ontario of a mining industry which would furnish profitable employment for thousands of men and comfortable homes for their families.

TOWNSHIP SURVEYS.

3. That the Government be recommended to proceed as rapidly as possible with the completion of the system of Township Surveys in what is now the unsurveyed territory of the province; said surveys to accurately describe the topography of each particular township, and, if possible, the geological formation to be added, the stakes to be of a permanent character, the townships first surveyed being those which are most likely to attract explorers and purchasers.

In different portions of the province, particularly in the District of Algoma, there are large areas of mining lands about which absolutely nothing is known, the lakes and streams not even being noted on the Government maps. Explorers are consequently deterred from prospecting in such territory owing to the great expense of making surveys. Complaint is made that some of the townships already surveyed have been done in such a manner that the work has almost to be done over again in order to be of service.

REGULATIONS AS TO THE PURCHASE OUTRIGHT OF MINING LANDS.

4. (*a*) That all applications for the purchase of mining lands in unsurveyed territory shall be made upon the following basis: The party so applying shall have caused the land so applied for to be staked out and bounded by blazed compass lines to conform as nearly as possible with proposed surveys; the application shall be accompanied by a sketch showing its position and area, and a fee of $5.00 for every forty acres or fraction thereof so applied for within 90 days from the staking out; the party so applying shall complete at his own expense the surveys of as much of the land so applied for as he shall elect to purchase and pay the purchase money, $2.00 per acre, to the proper authorities. Failure to either complete the surveys or pay the purchase money to be a forfeiture of all rights under said application, which shall not be renewable, and to entitle any other person to survey and purchase any or all of the lands included in such application.

(*b*). That in surveyed territory no application shall be received or entertained for the purchase of mining lands unless it be accompanied by a deposit of one dollar per acre on the lands so applied for, the balance of the purchase money to be paid within sixty days from date of said application; default in payment on said balance to constitute a forfeiture of the deposit, and to entitle any other person to purchase said lands.

It is believed by your Committee that the present custom of allowing blanket applications, covering immense tracts in unsurveyed territory, and the surveying of not only single locations, but large numbers of locations, and filing the surveys in the Department with no deposit in either case, or a nominal one, is most prejudicial to the best interests of the province, as it allows speculators to tie up large tracts of country which it is not their intention to purchase. In surveyed townships the custom of making applications with either no deposit or a nominal one, has the same bad effect, and the suggestions made in Clauses A and B are intended to prevent the tying up of land in this manner, but not to interfere in any way with *bona fide* investors who are prepared to pay for their purchases.

EXPLORERS' RIGHTS.

5. (*a*) That in unsurveyed territory explorers be allowed to stake out and apply for claims in a similar manner to that provided in Section 4, Sub-section A, of not less than 40, nor aggregating more than 160 acres, to be accompanied by a fee of $5.00 for each 40 acres so applied for, a certificate to be issued allowing the completion of a survey, and filing the same within ninety days of the date of staking the claim or claims. A new certificate shall then be issued entitling each applicant upon the expenditure of fifty dollars per annum in development work on each forty acres for two years, or $100 at any time within one year, to a patent upon payment of a sum of $1.00 per acre.

(*b*). That in surveyed territory explorers be allowed to apply for a claim or claims of not less than 40, nor aggregating more than 160 acres, the application to be accompanied by a fee of $5.00 for each 40 acres, a certificate to be issued allowing the applicant within ninety days of filing such applications, upon payment of one dollar per acre, to take out a new certificate, which, upon the expenditure of $50 per annum in development work on each forty acres for two years, or one hundred dollars at any time within one year, entitle the applicant to a patent without any further payment or fee.

(*c*). Non-fulfilment of any of the conditions of Clauses A and B entitles any other person to make such application.

It was considered by the Committee that every inducement should be offered to legitimate explorers to prospect Crown Lands as much as possible. The fact that in unsurveyed territory the cost of the surveys which he has to make will about equal the $1.00 per acre which has to be paid in the surveyed territory within about the same time, will show the *bona fides* of the applicant, and prevent the locking up of any large tract of land with no intention of completing the conditions. With the immense tracts of land still owned by the province, it was not considered advisable to limit either the purchaser, without conditions, or the explorers in the area to be taken up. It is an undisputed fact that the men who were practical in either case, only take such lands as they may consider of value, and the chances are that the bulk of the tracts taken up by those who do not understand the situation are worthless, and well sold at the Government price. It is believed by the Committee that offering liberal inducements to explorers to spend money on actual development of their properties, will tend more to advance legitimate mining in Ontario than any other possible method. Such has been the history of mining all over the United States, and while the recommendations here made are not as onerous as the American, they are sufficiently so to prove within a very short time whether they are of value or not.

EXEMPTING APPLICATIONS FOR LAND.

6. That all applications for the purchase of lands, when not surveyed, or completed surveys now lodged in the Crown Lands Department, where the purchase money is not paid, under the existing regulations, be treated as follows: When the application is not accompanied by a survey, the surveys shall be filed for same before July 1st, and the purchase money paid on these as well as in surveys not accompanied by purchase money before Sept. 1st, all new transactions to come under the new regulations after the passing of the Act, and on old transactions, failure to comply with these conditions to entitle any person to make application under the new regulations.

It is believed by your Committee that unless this be done, much hardship would ensue, not only to the explorer, but to the men who have in good faith applied to purchase mineral lands.

MINING OFFICES AND AGENTS.

7. That mining offices should be established at the most convenient centre for each mining district. That these offices should be presided over by a reliable and responsible agent, to whom all applications for the purchase of, and all business connected with the purchase of mineral lands shall be transacted; this office to contain a record of the patented lands, and of all applications for lands in that particular district; those records to be open for inspection by the public upon payment of a nominal fee, as in Registry Offices, maps of the different townships, etc., to be furnished free or at a nominal price.

Your Committee finds that the present system of conducting this business through the Crown Lands Department is not only slow and laborious, but inconvenient and expensive to the prospector. Much delay and expense, and the clashing of applications would be avoided if made only through the office for each particular district. The furnishing of maps and information, as suggested, would be not only a great boon to the explorer, but would lessen the labor, trouble and complications in the Department, and at the same time the application and other fees would more than pay for the administration of such offices. These should be established at such places as Rainy River, Rat Portage, Port Arthur, Sudbury, North Bay, Sault Ste. Marie, and as many others as the business would warrant.

TAXES ON MINING LANDS.

8. That the present system of taxing mining lands in districts without municipal organization be continued; but the system of selling for arrears of taxes be discontinued, and instead, that when the lands are two years in arrears, they be advertised, and if the taxes and advertising costs be not paid within one year from the date of such advertisement, that these lands revert to the Crown and come under the then existing regulations as if they never had been sold.

Your Committee find that the amount realized by the Government for unpaid taxes, while not large at any time, is in many cases sufficient to cover many thousands of acres of land, which is then bought at the sale for a comparative trifle by speculators, who will neither sell nor improve the property. Thus the re-selling at the Government price of even a portion of these lands would more than cover any loss of revenue that might ensue.

FREE GRANT PATENTS.

9. That all patents for lands under the Free Grant or similar acts should not contain a reservation of the minerals to the Crown.

The hardships and trials of a settler in a new district are sufficient as it is, to make him entitled to any value that there may be in his land for minerals after he has done the settlement duty and received his patent, and there certainly should be no reservation of the minerals.

ROADS AND RAILWAYS.

10. That liberal grants should be made for the building not only of highways but railways throughout the mining districts.

There are millions of acres of Provincial lands which are wholly inaccessible by any other than a canoe route, and cannot be mined without roads. The judicious and liberal expenditure of money in roads, and in some cases, where experience has proven the value of the district, in railways, would tend not only to promote actual mining, but the additional sales caused by such expenditures would more than reimburse the province for its outlay, besides adding largely to its population and wealth.

MINING SCHOOLS.

11. That Mining Schools should be established throughout the province at the most convenient points for the practical education of mining men.

These schools should not only be capable of educating the youth of Canada as mining engineers, geologists, metallurgists and practical mining men, but every convenience should be given so that miners and prospectors who have not the technical education, might at least learn sufficient of the rudiments of geology, mineralogy and metallurgy, to enable them to work more intelligently and with better results in exploring the great unknown lands of the province.

DIAMOND DRILLS.

12. That the province should purchase and own a diamond drill at each mining centre, these drills to be rented to prospectors at actual cost of wear and tear and operating expenses.

Your Committee finds that the cost of a diamond drill is such that none but wealthy land owners can buy them, and it believes that diamond drilling done judiciously is the most successful method of testing and exploring such ore deposits as iron, copper, nickel, etc., and that the purchase and leasing thereof by the Government would tend to develop such ore bodies much more rapidly than at present.

SUGGESTED ACTION.

13. Your Committee recommends that united action be taken, particularly by the Boards of Trade and other representative bodies of Algoma, in impressing upon the Government the necessity for amending the laws with regard to the sale of mining lands, and the adoption of such a mining policy as is in accordance with the suggestions herein set forth.

PROPOSED REGULATIONS.

14. That the Government of the Province of Ontario be requested to furnish this Board with a copy of any proposed regulations or amendments at as early a date as is possible.

The Committee desires to thank those gentlemen, not members of it, who were good enough to aid the Committee's researches in every possible way.

All of which is respectfully submitted.

GEORGE T. MARKS,
Chairman.

PORT ARTHUR, ONT., February 4th, 1891.

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Iron and Steel Wire Ropes.—Mr. A. H. Stokes, one of Her Majesty's Inspectors of Mines, recently read before the Derby Society of Engineers an interesting paper on "Iron and Steel Wire Ropes, Chemically, Microscopically, and Mechanically Considered." The importance of the subject was shown by pointing out that in the United Kingdom alone upwards of 500,000 lives were daily trusted to the efficiency of these appliances. The tensile resistance of the wires is readily ascertained by taking out a few feet of wire from one end of the rope. Suspending the wire from some convenient attachment, it is made to hold up an empty tub at the lower end. Water is then carefully poured into the tub until when the tensile limit of the wire is reached it breaks. Afterwards the water in the tub can be measured and the breaking strain calculated. For testing resistance to torsion, a piece of the wire, 8 inches long, might be screwed up tight at one end in an ordinary smith's vice, and the other be held fast between the plain faces of a pair of dies in stocks, which have only to be rotated, and the number of whole turns before the wire breaks carefully counted, to ascertain the torsional limit. Steel wire should stand 28 twists.

Notes on Coal Mining.*

By Mr. J. S. Burrows, F.G.S.

My immediate predecessors in this Chair having given our Society valuable addresses on prices of coal, wages paid, and the duration of our coal supply, it is to be hoped that a few remarks on the early history of the coal trade, and the conditions under which coal mining will probably be carried on in the future, may be of interest. For the following historical details I am indebted to Mr. Boyd's book on "Coal Mines Inspection," a work which will well repay perusal.

Coal was dug on the Castle field, at Newcastle-on-Tyne, in the year 1239, and 70 years later we find a Royal Proclamation forbidding the burning of "sea-cole" in London. Curiously enough, monks and abbots figure amongst the earliest colliery proprietors, both in England and Scotland.

Early in the 14th century, coal was worked to such an extent as to become a source of revenue from taxation. There are accounts in existence of serious explosions of fire damp, which occurred in North Wales, the Midlands, and Durham about the close of the 17th and commencement of the 18th centuries; that near Chester-le-street, in Durham, causing the death of 69 persons, including at least one woman. The winding shaft of the colliery where this last named explosion occurred, was 114 yards deep, showing that coal mining was being carried on under conditions approaching our own as to depth. The miners worked long hours in a foul atmosphere, and numerous accidents occurred upon which no inquests were held till about 1814. Progress in coal mining, and efforts to improve the lot of the miner, may be said to date from the commencement of this century. In the year 1800, the total amount of coal raised was estimated to be 10 millions of tons, which amount had increased to 27 millions 16 years later..

Candles were ordinarily used for giving light underground, and the flint and steel was for years the only substitute where candles could not be used, owing to the presence of explosive gas. About 1815, Sir Humphrey Davy and George Stephenson introduced the so called safety lamps, bearing their respective names. Dr. Clanny had also brought out a cumbrous form of his lamp two years before this. At this time, according to Mr. Buddle, the furnace, waterfall, steam ventilator, the air pump, and the heated air pipe or cylinder, were known, and he stated that "the standard air course or current of atmospheric air which I employ in the ventilation of the collieries under my care, abounding in inflammable gas, moves through an aperture from 30 to 40 feet in area, with a velocity of 3 feet per second, which equals 5,400 to 7,200 cubic feet." This he thought sufficient, and as the next step he looked for the discovery of some chemical process for rendering explosive carburetted hydrogen harmless.

His experience was "that the ordinary and unavoidable casualties in collieries occasion more calamity than explosions of inflammable air." From this time, for many years, the Davy, Stephenson and Clanny were the only safety lamps used in this country; but, during the past ten years, these lamps have been largely superseded by the Mueseler and Marsaut types of lamp, which, though far from perfect, are a great improvement on their predecessors.

During the past sixty years a marked improvement has taken place in the condition of our underground workers, partly owing to increased knowledge on the part of employers and workmen, and partly to Acts of Parliament. In 1831, the first Truck Act became law; in 1842, Lord Ashley's Act was passed forbidding the employment of women and girls underground, and providing that boys under ten should not be employed except such as were already at work in the pits; that wages should not be paid at or near a public house, and empowering the Secretary of State to appoint inspectors, the first being Mr. Tremenhure. In 1847, Mr. Duncombe, the then member for Finsbury, introduced a bill providing for the appointment of three inspectors, for payment by weight, and for weekly pays, but had to withdraw the measure. The same gentleman introduced a second bill later in the same year, to prohibit the use of naked lights and gunpowder in fiery mines, but this bill was rejected.

The Act of 1850 established the principle of underground inspection, Messrs. Blackwell, Dunn, our present inspector, Mr. Dickinson, and Mr. Morton, being those appointed. The next Act, passed in 1855, set forth seven general rules, and provided that special rules should be drawn up for every colliery. Some of these proposed special rules are worth noting. One rule sought to make it an offence for a collier "not to attend Divine Service at least once on the Lord's Day;" and the object of another was to prevent a workman coming to his work "on a Monday morning dirty, or with an old beard." These last two Acts had each been limited in operation to a period of five years, but the next Act of 1860 was to be perpetual, and it provided, amongst other things, for the education of boys, and for the inclusion of certain ironstone mines worked in connection with coal. In 1862, after the terrible accident at Hartley Colliery, a short Act was passed requiring two means of exit for the workmen at each colliery.

The next Act, of 1872, introduced a new feature; from this time managers of mines were required to hold certificates of service or competency. The Home Secretary received 3,596 applications for certificates of service, which, it is needless to say, were not all granted. One sub-inspector was also appointed in each district to assist the inspector. With the provisions of this Act, and of the later one of 1887, most of us are, or ought to be, well acquainted. One clause of this Act, General Rule 9, requires that "safety lamps, wherever used, shall be so constructed that they may be safely carried against the air current ordinarily prevailing in that part of the mine in which the lamps are for the time being in use, even though such current should be inflammable." This is a very severe test to apply to any lamp which requires oxygen to support combustion, or, in other words, which cannot be hermetically sealed from contact with the surrounding atmosphere; and, though the Mueseler, Marsaut, and other lamps in careful hands, and after careful examination, may stand the test, every manager of a mine must have constantly in his mind the serious consequences of an oversight in the putting together of the lamp. Instances have been known where shielded lamps have been taken down the pit without gauzes, and often with the glasses so slack that not only could the glass be moved round with the fingers, but the flame could be blown about by the breath. In my opinion a lamp cannot truly be called a safety lamp which depends for its safety on the most unremitting personal care and attention, and which in the absence of such care is simply a naked light. A few years back great hopes were raised that portable electric lamps were so perfected as to be able to displace oil lamps, but I regret to say that this expectation has not yet been fulfilled. The advantages of such a lamp are too obvious to need comment—the beautiful light, hermetically sealed from contact with the surrounding atmosphere, seemed the very thing required for our coal mines. There are two forms of this lamp, one with a secondary battery, requiring to be charged from a dynamo, and the other with a primary battery, where the waste of the elements is replaced by refilling like an oil lamp. I have not been able to secure one of this latter type. Lamps of the former or secondary battery type, in my opinion, only require to be a success that the arrangements should be so altered as to prevent the charging solution (1 part of sulphuric acid to 9 parts of water), from getting to the metallic connections and so destroying them.

The charging is simple, a current strength of 7-10ths of an ampère at a potential of 10 volts for 10 hours, is all that is required, and I trust the makers of the lamp will persevere till they have overcome what is the only drawback. Being somewhat disappointed with the portable electric lamp, I intended ere this to continue the electric cables into a few working places and light them by the ordinary incandescent lamps as an experiment, but have not yet found an opportunity. The lighting up of surface works and pit bottoms of collieries is pretty common now, still a few suggestions based on experience as to the best means of fitting up an electrical plant may be of interest to some who have not yet tried this system of lighting. The first requisite is a good pair of coupled engines, well up to their work, and used solely for driving the dynamos. Most of us begin by trying to make use of some engine already at work, such as a fan engine, and end by getting special engines for the purpose. A good governor to the engines is an absolute necessity; there are several to select from, but many electricians recommend Pickering's governor as being the most sensitive. It is well to have two dynamos (one working and one in reserve) of a good substantial pattern, compound wound, with the commutator of large diameter and plenty of copper in it to wear at. I fancy that there is less sparking at the brushes with a commutator of large diameter than with one of less diameter, but would not like to say that this is the only reason for the evident superiority of one machine over another in this respect—there may be other causes. A short time back I used to be very much puzzled with the terms volt, ampère, etc., when reading or hearing a description of electrical apparatus, and as there may be others present to whom the terms are unfamiliar, I venture to transcribe the following text book definitions:—

"The Volt is the measurement of pressure."

"The Ampère is the measurement of the rate of flow."

Dynamos for lighting are usually made for an e. m. f. of 100 or 110 volts, the number of current ampères depending on the size of the machine, or in other words the number of lamps it is intended to supply. A 16 c. p. incandescent lamp requires $\frac{6}{10}$ ampère at 100 volts, so that a 100 light machine would supply 60 ampères of current and so on. A copper wire of No. 16 Birmingham wire gauge will convey a current of 3⅔ amperes without heating, and serve six 16 c. p. lamps. Each dynamo should be supplied with a series of resistance coils, say 10 in number, giving a range of about 40 volts by moving the switch across the 10 steps without altering the steam throttle valve. For instance, if 20 lamps are switched off, the engine, having less work to do, quickens its speed, drives the dynamo faster, increasing the volts, and wearing out the lamps.

With resistance coils the small handle is simply moved back a sufficient number of steps till the volt meter again shows 100 volts. Large magnetic cut-outs should be placed near each dynamo to cut off the current when excessive, owing to the engine running away, or a short circuit. With a table showing the quantity of current wires and cables of various sizes will safely pass, and the Phœnix Fire Office rules as a guide in fixing, an intelligent workman, who has previously assisted a professional electrician in fixing an installation, can himself erect a satisfactory and workable plant. There are various plans of securing the cables in the shaft, wooden or vitreous cleats being the most common. I have on the table a glass insulator and bracket supplied by the Manchester Edison Swan Co. Ld., for securing the leads. The idea is to run the cable through the round glass insulators which, by a projection on the glass, are held securely in the brackets which have been already screwed or driven into the wooden bearers, or brickwork. The cable is then fastened in the glass insulator by the vulcanized conical wedge piece, and in shafts the glass should be filled in with composition applied hot, and rounded off at the top, to prevent water lodging round the cable in the glass insulator. Wooden insulators (not oak), boiled in paraffin wax are also supplied instead of glass ones, the mode of fixing being exactly the same in both cases. Latterly we have put our cables in the shaft 4 feet apart to avoid the risk of short circuiting, though a few inches of space between the leads is sufficient for all practical purposes. The loss in transmission is 2 volts at a point 330 yards from the dynamo when a number of lights are taken off, and 6 volts at 450 yards from the machine.

As to the future of coal mining, when coal will have to be won at great depths, and at a correspondingly high temperature, experts seem unanimous in thinking that the winding arrangements will prove no obstacle, but that the temperature probably will. Our late President, Mr. Hall, in his interesting address, concluded "that with our present knowledge and appliances (which, however, must by no means be considered finite), where temperature due to depth reaches 100°, coal cannot be worked except at very great expense, if at all." As the temperature at 4,000 feet in depth would be 116° or more, it would indeed be a very serious outlook if high temperatures should seal to us the 29,000 millions of tons estimated to lie between the depths of 4,000 and 6,000 feet.

The temperature of the spinning rooms in a cotton mill is never allowed to fall below 84° F. if it can be avoided, and in summer I have found the thermometer standing at 90° and up to 96°. What the temperature is in front of the puddling furnaces, rolling mills, Bessemer pits, or hammers in a large iron or steel works, I am unable to say, but it is certainly very high. In some of the large Atlantic passenger steamers the temperature in the stoke holds is often 160° F., and I have been told that when repairing a boiler, buckets of iced water are used to cool down the tools so that the men can handle them, yet Europeans work in this temperature four hours at a stretch, with an interval of eight hours before the next turn. In passenger steamers coming up the Red Sea, the stokers face a temperature of 180° F.; I believe these men are mostly natives of warm countries, but whether they are employed because Europeans cannot stand the heat, or from motives of economy, I do not know. Mr. Merivale says that in some of the Comstock Lode silver mines, Nevada, work was in 1877 carried on at a temperature up to 123°, the rock having a pretty uniform temperature of 130°, this great heat being due to the hot springs, some of which have a temperature of 158°. Undoubtedly when we have to deal with temperatures of this magnitude, nay, long before, the ventilation will have first of all to be very largely increased, and at the same time the work to be done by the colliers made very much lighter.

Without pretending to any gift of prophecy, I can conceive of a time when electricity will be carried throughout the workings of a colliery, both to give light and supply power. Though much must be done before electricity can be applied in this wholesale manner, enough has already been done to show that, if certain difficulties can be overcome, such as sparking at the brushes, the use of electricity in coal mines is quite feasible, and, I think, economical. When necessity compels its use, wonderful progress will soon be made. A locomotive of 100 horse power, driven by electricity is now at work in the new underground railway in London and I am proud to think that our fellow townsmen, Messrs. Mather and Platt, have been so successful in their enterprise. I have cut the accompanying sheet from the advertising pages of the *Iron and Coal Trades Review* to show that machines for coal cutting and drilling, driven by electricity, are in the market, though I have not seen any at work.

Pumping by electricity is, and has been, an accomplished fact for some time in the Forest of Dean, Yorkshire, and elsewhere. A 40 horse power electric locomotive, weighing 5½ tons, is now at work at an American colliery hauling tubs on a level underground, and the lighting is done by the same cables, apparently with success. If, then, we can reduce the labor of the collier to supervision of his coal-cutting machines, spragging and propping and filling coal into tubs, all of which operations can be performed in the full current of air, we shall have done a great deal towards making the higher temperature bearable.

We have now working at Atherton collieries a small experimental plant for winding coal tubs up a down brow, the motive power being electricity. The generator dynamo on the surface is driven at a speed of 1,230 revolutions by the engine which drives the lighting machines. It is series wound, and was constructed to work at a potential of 300 volts, and to give out 6 horse power on the shaft of the motor below ground. Two insulated cables, each of $\frac{7}{16}$ s. copper wire, are led down the winding pit to the motor at the top of the down brow, a total distance of 448 yards. The motor below is a fac-simile of the generator on the surface, and makes 1,000 revolutions per minute. From the pulley, 8 inches diameter on the motor shaft, a belt drives either a fast or loose pulley, each 54 inches diameter, on the worm shaft. The worm gears into a worm wheel of 40 teeth on the drum shaft; the drum, which can be put in and out of gear by a clutch, is 2 feet 6 inches diameter, is fitted with a powerful brake, and makes about 8 revolutions per minute. It must not be supposed that this is put forward as a good arrangement; the worm is a very wasteful contrivance for transmitting power, and was adopted, firstly, to prevent any risk of the full tubs running back should the motor break down; and secondly, to reduce the speed of the drum without having recourse to counter shafts or toothed wheels. As at first arranged, the motor shaft was coupled direct to the worm shaft, and an ordinary switch was employed, but this plan failed completely. When the current was switched on the inertia of the motor, worm, and drum was so great that the main driving belt was thrown off the fly wheel of the steam engine. The present arrangement of fast and loose pulleys was then substituted, along with a new switch having six steps, five with resistance coils and the last one open, so as to pass the current gradually. The motor is kept constantly running with the belt on the loose pulley of the worm shaft, and the switch on the first step. When it is desired to wind up the tubs the belt is moved on to the fast pulley, and the switch handle is moved step by step till the full current is on. This arrangement works continuously, and has never failed except when the break down could be clearly traced to some defect in construction of the generator on the surface; in fact, with first-rate appliances, there seems no reason to fear a break down any more than with a steam engine, and, if you keep a spare armature in reserve, the faulty armature of either machine can be replaced in 30 or 40 minutes. As the worm probably loses 50 per cent. through friction, and is not necessary with a good brake to the drum, in putting up another plant I should use ropes, belts or toothed wheels, or possibly a combination of these. The length of the brow is at present 220 yards, the gradient is 1 in 5 till near the top, where it is 1 in 4 for the last 20 yards. A full tub of coal weighs 13½ cwts., and the motor can bring up four full tubs at a time, though two are sufficient for ordinary requirements. The time occupied in winding is about seven minutes, and the amount of work performed by the motor when winding four full tubs, assuming 50% to be lost by friction of worm, etc., is:—

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* Paper read before the Manchester Geological Society.

	H. P.
Where the brow is 1 in 5	6·6
" " 1 in 4	8·2

We have made some experiments to determine the loss in transmission between the surface generator and the underground motor with varying loads, the result showing an average loss of 10·12%. A large dynamo has been proved to give out 93% of the power applied to the driving pulley on its shaft, so that so far as the dynamo or generator goes, considerable efficiency has been attained; and, taking all into account, electricity seems to be more profitable than compressed air as a motive power. Experiments made at Powell Duffryn Colliery showed that the indicated horse power in the cylinder of an engine worked by compressed air was only 30·8% of the indicated horse power in the steam cylinder used for compressing the air.

Now if we take two steam engines, one used for generating electricity for driving an underground hauling engine, and the other compressing air to be used in a like manner, and assume that 100 horse power is shown by the indicator diagram taken from each steam engine, the useful effect would be for electricity:—

	H. P.
Indicated horse power of steam engine	100
Efficiency of steam engine say 60%	60
Friction and slip of belts, say 10% of this leaves	54
Efficiency of generator, say 93% this leaves	50·2
Loss in transmission through cables, say 10%, this leaves	45·2
Efficiency of motor, say 93%, this leaves.	42
As against efficiency of air engine cylinder	30·8
A difference in favor of electricity of	11·2
Or 36% over compressed air.	

In putting up a large electro-motive plant the first cost would probably be less than for a similarly powerful plant for compressed air. Assuming the steam engines to be the same, the generator, belts, and counter shaft would not cost as much as the air compressing cylinders and receivers, the air pipes, bearers, and cost of fixing the pipes would well cover the cost of the cables, and the motor and shafting underground would cost no more than the air engines, and the drum or other hauling gear would be the same in both cases. Against all this there is one great drawback, namely, sparking at the brushes; in a main road this would not perhaps matter much, but it would prevent the application of electricity as a motive force in the workings unless some means be found to obviate the danger.

In conclusion, it seems to me that very little progress has been made in the 600 years of coal mining, especially in the lighting of mines and in appliances for saving manual labor, but in time, electricity will revolutionise both our defective means of lighting, and our old fashioned plan of getting coal by hand labor. I know that coal cutting machines have been tried from time to time during the past thirty years, but (apart from any imperfections in the machines themselves, the hitherto abundant supply of labor, and the great cost of air-compressing plant), I believe that the difficulty of maintaining rigid iron pipes in mines, where the floor lifts, and where the roof falls or has to be taken down, has deterred many from giving machinery a trial. The laying and maintenance of flexible electric cables would be a much simpler matter, and they could easily be removed when desired. Certainly, electricity is yet in its infancy, but it is a promising infant, and is likely to develop into a giant some day. Let me, then, earnestly recommend our younger members to avail themselves of the many opportunities of acquiring some knowledge of electrical science before the responsibility and work, inseparable from the management of large concerns, leaves them little leisure, and often less inclination, to take up more brain work. To our older members I venture to suggest that it is worth while encouraging, so far as may be, the efforts of those who are seeking to provide us with a servant so powerful and efficient as electricity.

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Mica Mining in the United States.

As to the origin of the mica veins no definite opinion can now be offered. They can hardly be regarded as essential members of the strata in which they occur. They are of later origin than either their hanging or foot wall, and their contents reveal an igneous or aqueo-igneous origin. While, indeed, they for the most part, have the strike and dip of the inclosing rocks, as at the Balsam Gap mine, Buncombe County, and the Westall mine, Yancey County.

In the efforts of the vein matter to insert itself, the inclosing rocks have been twisted and contorted in many directions and in various degrees; in one instance, according to Professor Kerr, (*a*) forcing the rocks into opposite dips at the surface.

The New Hampshire deposits, according to Professor Slater, (*b*) "Appear to be obscure beds, closely following the general run of the apparent bedding that characterizes the granites in this part of the country."

The North Carolina deposits, on the contrary, appear to have arisen through the injection of material from below, the fissures following indeed the general run of the bedding of the inclosing rocks, but cutting across this when the line of least resistance did not coincide with a plane of stratification. That the vein material in filling the fissure met with great resistance on the part of the contiguous rocks is shown by the contortions, foldings and disruptions which they exhibit. It might well have happened that at times there was less resistance transverse to the bedding than parallel to it, and at such times the fissure would partake of the nature of a true lode.

The crystallized quartz would seem to indicate a crystallization from an aqueo-igneous solution. This is rendered the more probable by the occurrence of thin sheets of quartz between sheets of mica and by the impression of the edges of mica sheets on fragments of well crystallized quartz, forming a sort of pyramid with microscopic steps. So far as known this latter phenomenon has not been observed on the feldspar, though thin sheets of this also have been found between sheets of mica. The impression of the edges of mica sheets upon the quartz would seem to indicate that the mica crystallized first, and in so doing inclosed at times some quartz between the layers, and at other times some feldspar. It is not here discussed whether in the aqueo-igneous magma filling the fissure, the mica, quartz, and feldspar were present as such, but bearing in mind what has been said as to the impressions on quartz, and the inclosures of quartz and feldspar, it would appear that in the order of crystallization we have mica, feldspar, quartz. Although the inclosing rocks offered considerable resistance to the fissuring force, still after the entrance of the vein matter, it was free to crystallize in large, nearly pure masses.

Some blocks of mica are curiously bent and twisted, as if resistance had been offered to the free extension of the crystal, either by the wall or the matrix. From this or similarly acting forces comes the "A" mica, a striated mica with the strix forming the letter A, or rather a V, as there are seldom any cross lines. These striations are from 2 to 12 inches long, and inclose angles of 30° to 45°.

The curvature of mica blocks amounts at times to 10° to 15°. "A" mica is not saleable, as the striations interfere with its transparency.

In addition to these phenomena a shearing force would seem to have acted at times. Some blocks of mica are cut through and thin filaments of mica left adhering to the edges. This may have been caused by a slow slipping along the middle leg of a fold, as the edges do not exhibit the appearance usually caused by cutting or shearing with heavy instruments.

Associated Minerals.—The minerals associated with mica are numerous and interesting. From a list prepared by the late Prof. W. C. Kerr, and now published for the first time, they are as follows:—

List of Minerals Associated with Mica in North Carolina.

Albite,
Allamite,
Amazonstone,
Apatite,
Arethunite (? P),
Autunite,
Beryl,
Biotite,
Columbite,
Euxenite,
Glassy feldspar, (sanidin),
Garnet; red & black,
Gumnite,
Hatchettolite,
Limonite,
Magnetite,
Menaceanite,
Muscovite,
Phosphuranylite,
Rogersite,
Samarskite,
Thulite,
Torbernite,
Tourmaline,
Uraninite,
Uranocher,
Uranotil,
Yttrogummite.

Dr. F. A. Genth, for some time chemist and mineralogist to the North Carolina Geological Survey, has had the kindness to correct and supplement this list. He writes:

Amazonstone, perhaps.—Doubtful.

Autunite (Torbernite?).—All autunite.

Biotite, probably; but I have not seen it from mica veins, as far as I remember.

Euxenite.—Does not contain Ti O^2. Is not true euxenite.

Glassy feldspar (sanidin).—Very doubtful.

Pyrochlore.—In minute octahedrons at the Ray mine with black tourmalines.

Yttrogummite.—I do not know of any analysis having been made. Very doubtful.

Fluorite.—In pseudomorphous granular patches after apatite.

Apatite seems to be fluorapatite.

Orthoclase.—Often completely altered to kaolinite.

It is not known what Professor Kerr meant by arethunite, as the list was not found until after his death.

The Flat Rock, Deake and Mart Wiseman mines, in Mitchell County, and the Ray Mine, in Yancey County, are famous localities for nearly all these minerals. At the Wiseman mine there has been found a block of "A" mica, weighing nearly 200 pounds, and a piece of samarskite of 94 pounds. This latter mineral is worth about $1.50 per pound.

Dressing Mica.—The blocks of mica hoisted from the mine are sent to the stripping room, where extraneous matter, as pieces of quartz, feldspar, wall rock, and fragments of mica, are removed. The blocks are then split by means of wedges or heavy knives, and are sent to be "scribed." This scribing is an operation demanding considerable skill and experience, the purpose being to get from a given rough sheet the largest number of valuable sheets. The patterns by which the mica is scribed are pieces of tin, sheet iron, etc., of different sizes and shapes, as determined by the order from the manufacturers of stoves. By far the greater part of cut mica is used for stove windows and peep holes, and the size and shape of the pieces are determined by the special order, just as in special orders for firebrick. Formerly the size of the cut sheets largely influenced the price of clear mica, but now, although, of course, the quality is still regarded as of prime importance, the size beyond certain dimensions, say 6 by 8 inches, is not. The number of patterns varies from time to time. In Mitchell County, about one hundred different patterns are used, the sizes running in inches from 1 by 1 to 6 by 8, or as large as the stock will allow, increasing by one-fourth inch. The cut mica varies in value from 10 cents to $6 per pound, the average being not far from $1.75. One hundred pounds of good block mica may yield 33⅓ pounds cut mica; an inferior block may yield only 5 pounds; the average is 10 to 12 pounds. The writer is informed that a 100-pound block from the Flat Rock Mine gave 75 pounds of cut mica. This is the highest yield he has ever heard of, and is very far above the average. It will at once appear that upon the skill of the scriber depends, to a great extent, the yield of the cut mica. An unskilled scriber may get from a given block only one-half as much cut mica as one experienced in the art. After the blocks have been split and scribed they are sent to the cutters. These are workman provided with heavy shears, and they cut through the sheets along the scribing. The different sizes are then wrapped in paper, generally in 1-pound packages, packed closely in a strong box, and sent to market. As most of the mines lie remote from rail, 25 miles or more, the transportation is a considerable item of expense.

Mica Waste.—In mica mining there is a great deal of waste. Not only must the blocks be freed from adhering quartz, feldspar, etc., but the mica itself is subjected to close scrutiny, and all pieces unavailable for good sheets are rejected. Great heaps of quartz and feldspar accumulate about the mines, and great heaps of waste mica about the dressing house. None of these materials have as yet been much utilized. Prof. W. C. Kerr stated (*a*) that in the seventeenth century the Indians packed kaolin (resulting from the decomposition of feldspar) from the mountains of western North Carolina to the seaboard for exportation. The Indian name for the Smoky Mountains (Unaka), may thus have been derived from the Indian name for kaolin (unaketh, white). It has been proposed to utilize the feldspar (orthoclase), for the manufacture of potash salts, but the present large deposits of potash minerals, already soluble in water, at Stassfurt, etc., would perhaps prevent a successful business of this kind, even should the method be applicable. The waste mica might perhaps be used as an absorbent for nitro-glycerine in the manufacture of mica powder. It is sometimes used, finely pulverized and mixed with graphite or grease, as a lubricant. A little is used also for silvering wall papers and other decorative purposes. The ancients used it for adorning the interior of their palaces. If an economic use could be found for it, it could be had in large quantities, and at a cost of 10 cents a pound.

It has been stated (*b*) that the Carolina micas are much more extensively impregnated with foreign substances in dendritic and other forms, than the New Hampshire mica, and also that the twisted structure is more common in southern than in northern (New Hampshire), mica. If this is true, there is more waste from North Carolina mines than from those of New Hampshire, and the business must be more precarious in the former place. As regards the first two points the writer is not yet in a position to give an opinion. It may be true that North Carolina mica mines yield more off-color and "A" mica than the New Hampshire mines. We may even go so far as to agree that the geological differences between the two sections could account for it. Such general statements, however, unsupported by the facts upon which they may be based, should be received cautiously. In the North Carolina mines no very close watch is kept over the yield of clouded or "A" mica; it is extremely doubtful if any mine keeps any account of it. The proportion between the cut

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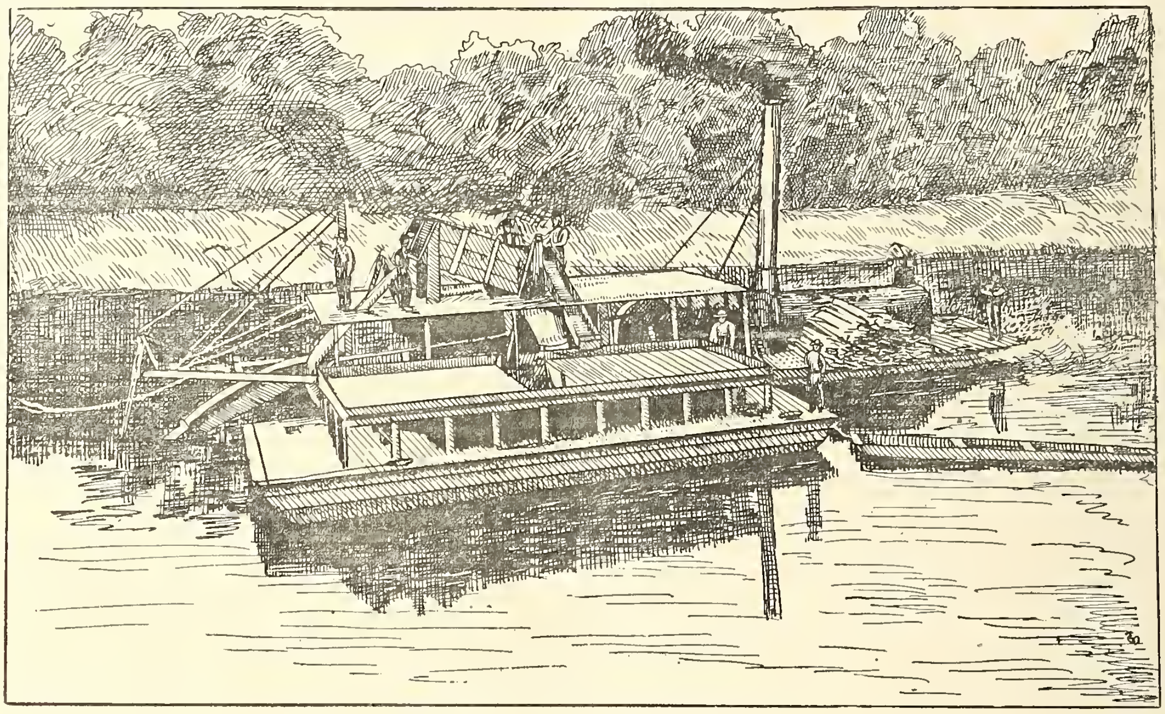
(*a*). Eng. and Min. Journ., vol. xxxi., No. 13, p. 212.
(*b*). Tenth U.S. Census, vol. xv., p. 833.

(*a*). Eng. and Min. Journ., vol. xxxi, No. 13, p. 212.
(*b*). N. S. Shaler, Tenth U.S. Census, vol. xv., p. 834.

mica and the waste mica affords no indication of the yield of clouded or "A" mica. It often happens that the waste mica contains no clouded and but little "A" mica. Some mines are famous for their clouded mica, while others have very little. The same is true of "A" mica. It is not known to the writer how strict and detailed a watch is kept in New Hampshire over all the products of the various mines, and therefore he cannot speak of them. But it is known that any assertions as to the yield of the North Carolina mines in clouded, twisted, or "A" mica rest upon very insecure data. The statistics as to the yield of cut mica are not satisfactory, and this is the only matter of much consequence. According to the United States Tenth Census there were in the United States in 1880, 78 mica mines, 71 of these being in North Carolina; of these 78, 22 were worked, 17 of them in North Carolina. The capital invested in the United States was $337,900, $6,900 being in North Carolina; total number of hands employed 272, in North Carolina, 177; total paid in wages $65,600, $29,650 in North Carolina; total production 81,669 pounds, valued at $127,825; North Carolina producing 42,669 pounds, valued at $61,675. Thus North Carolina had invested 2.42 per cent. of the total capital, employed 65.4 per cent. of the total labor, yielded 52 per cent. of the total product, and 48.3 per cent. of the total value. Based on the value of the product $1 capital in North Carolina in 1880 was equal to $44.65 in New Hampshire, her sole important competitor. This latter State had invested as real and personal property, $314,000, and the value of her product was $62,900. North Carolina had invested $6,900, and the value of her product was $61,675. It would certainly be a most remarkable business that yielded $8.93 per dollar invested, particularly so when it is remembered that of the stuff hoisted only from 10 to 12 per cent is utilized. If the twelve or fifteen mines operated in North Carolina in 1887 can show anything like such a profit as this, they can hold their output for several years yet. It is feared that such profits are forever past.



Dredging Florida Phosphates.

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Coal Mining in British Columbia, 1890.

We quote the following excerpts from the Annual Report to the Minister of Mines, by Mr. Archibald Dick, Chief Inspector for the Province of British Columbia:

"While all the mines are being worked with vigour and unprecedented energy, and with an immense investment of capital, for which there is the best prospect of a safe and profitable return to the lucky proprietors, I sincerely trust that the unhappy differences which have existed lately in this district will be adjusted, and harmonious relations be restored between differing employers and employed, as such a consummation would tend greatly to advance the coal industry and the prosperity of the community, as well as to place this Province in a proud position as commanding the market of the Pacific Slope, whether as to quality, quantity or price of the great staple article of necessary utility—coal.

"The outlook for the year we have now entered upon (1891) is the most promising that it has been my good fortune to experience for the coal industry; the harbors of the port of Nanaimo are replete with shipping of every possible size, from the largest ocean ships and steam vessels to the small towing craft and capacious barges, and the powers of the Collieries have been strained to the utmost to fill orders to the many comers. I need hardly say that the City of Nanaimo has been a large participant in this stream of prosperity that has visited the district, and I trust that it may long continue and increase.

NANAIMO COLLIERY.

"The coal from this colliery was in good demand during the past year.

"**No. 1 Pit, Esplanade, in Nanaimo.**—This mine, forming part of the Nanaimo Colliery, belongs to the New Vancouver Coal Mining and Land Company (Limited). As in the previous year, the workings in this pit have been from what is known as No. 1 and No. 3 North Levels. All the workings from these levels are under the water of the Nanaimo Harbor, and are getting to be very extensive. The No. 1 Level with its windings is in about 2,800 yards from the shaft in a north and westerly direction. In this division of the mine they have taken much coal during the past year, the coal being of a first-class quality, hard, and will average about seven feet thick. They have drifted or run the level in about 800 yards, without a fault or hitch of the smallest kind. Here they have as many employed, considering the distance, as they can take coal away from; and at present they have coal won where they could employ 100 more men than what are now employed in this district of the mine. At the back of the level they are only a few yards from working under Protection Island, under all of which, I have reason to believe, lies this famous and valuable coal. In No. 3 level there has been much prospecting and exploring done. They are now getting out a considerable quantity of good coal, but they do not seem to have got into the extensive field where No. 1 is, although they are working towards it and expect to get in soon.

"Ventilation is good. Motive power, two fans, both on the Murphy principle, worked by two steam engines. The fan machinery is erected near the top of the up-cast shaft. The last time that I was down (in December) I found that there were 60,000 cubic feet of air passing per minute for the use of 90 men and 15 mules. The air is well conducted into the face by brattice or otherwise.

"This mine is ventilated on the separate split system, the main division being near to the bottom of the shaft; the part or current going to the No. 1 level, and the other down the slope for the No. 3 level workings. Here they are extensively using brick to build stoppings to conduct the air in the main airways. There is very little gas now found.

"In this mine, as in all other mines of the colliery, a deputation of men is sent once in each month to examine the mine, under Section 79, General Rule 31. The finding of the condition of the mine is recorded in a book kept for that purpose; and a notice is put up where all may see it.

"**No. 3 Pit (Chase River), Nanaimo Colliery.**—This is mentioned in a previous report as being near to the mouth of Chase River. With the exception of a short stoppage in the early part of the summer this mine has been worked steadily. The coal from here is of a very good quality, and hard. As it is worked on the pillar and stall system and that by a slope, and having got as far as it is intended to go at present, all the mining is at the pillars (coal), which were left behind to support the roof, those pillars being fully one half of the coal that was in the mine at the start, so that there is yet a large output to be got here.

"Ventilation is good. Motive power, a fan on the surface near the top of the up-cast shaft. The last time I was down I found that there were 50,400 cubic feet of air passing per minute for 69 men and 9 mules.

"This mine has been free from gas since the start, and it is also free from dust.

"**South Field Mine, No. 1 and No. 2.**—These mines are now what are known as the South Field Mine.

"This mine is worked by a slope from the surface, and is now down about 800 yards, but at present it is not worked in the bottom, and nearly all the coal came out from the south side. It has been the greatest producing mine of the colliery. This coal is of a very good quality, and in some parts is about 18 feet thick, but as in the other mines it had faults now and again to contend with. The coal is mined on the pillar and stall system.

"Ventilation is very good. Motive power, a large fan, on the up-cast shaft. This is also ventilated on the separate split system. The air is taken in by both No. 1 and No. 2 slopes, the up-cast shaft being put down between them, and is found to work well in ventilating the mine. The last time I was down, in December, there were 40,000 cubic feet going down the No. 1 slope, and 80,000 going down the No. 2. slope, total 128,000 per minute for the use of 149 men and 18 mules. There is now very little gas found in this mine, which is also free from dust.

"**No. 4, South Field Mine.**—This is the slope mentioned in a former report, and about half a mile from No. 3 pit. It is down about 1,000 yards with a long level to the south side. The company have been to a great expense here, and at times prospects looked favorable, and it was reasonably expected that good coal would be early found here, as they have good coal coming this way from No. 3, and also from bores they put down away to the dip only a few hundred yards ahead; yet, with all those encouragements, the prospects are not looking very favorable; but it is to be hoped that there will before long be a profitable mine here, the location being good, and well situated for other works.

"**No. 5, South Field Mine.**—This is a new shaft which the company are putting down to the dip and north of the working of No. 2 slope, after having put down a series of bore holes. The prospects from those holes gave them encouragement to start the above shaft, which is now down 100 feet: and they expect to reach the coal a little over 500 feet from the surface. As the company have got machinery and head gear up, to be used in the sinking, it may be expected that, in the absence of unforeseen accident, the company will get to the coal early in the summer, and this will be quite an acquisition to the proprietors.

"**North Field Mine, Nanaimo Colliery.**—This mine is mentioned in a previous report as being in the northern part of the New Vancouver Coal Company's extensive estate. The mine has been worked continuously during the past year, the coal varying in thickness from three to six feet, and is very hard and of a very good quality. It is in good demand both in the Victoria and California markets, and commands the highest price.

"The coal is worked on the long wall system, by a level, and slopes from the bottom of the shaft. This is the only coal mined upon that system in this colliery, and on account of the thinness of the vein the system works well.

"Ventilation is good. When I was down in December I found there were 23,400 cubic feet of air passing per minute for the use of 56 men and 3 mules. This is conducted on the separate split system, the intake being the east level and slope; this comes back by the returns, and eventually rises up and out of one apartment of the shaft walled off. Close to the top on the surface is erected a fan.

"During the past year the company have been sinking another shaft, which is about 70 yards west of the hoisting shaft, and had got down to the coal and connected with the works at the end of December, so that once they get these works arranged this second shaft will be their return or up-cast shaft, and will also form a second connection or outlet with the surface.

"Little or no gas has ever been seen in this mine.

"Two years ago there were nothing but woods here, but now that the New Vancouver Coal Mining and Land Company have extended their works, and the Hamilton Powder Company have also started their works in this neighborhood, there is quite a town springing up, which is likely to grow, and flourish correspondingly with the progress of the coal and powder works, of which progress there can be no doubt.

WELLINGTON COLLIERY.

"**No. 3 Pit, Wellington Colliery.**—This pit, as has been mentioned in a previous report, is in the valley of the Millstone River. The workings are all by way of a slope from the south side of the shaft.

"In this pit much of the work is under the valley, which is sometimes overflowed at very high stages of the river. As well as mining underneath the valley, a great deal of work has been done below the high bluff overlooking the valley. The workings here have only been at pillars (coal), and that under the bluff, as it is not the intention of the manager to take any of the pillars from under the valley, until every other part is worked out; this is done as a safeguard against an inflow of water from the surface. They were working at the pillars up to the 16th May, when there was a strike, and up to the present time there has not been any coal taken out of this mine. Water was being pumped out as usual up to the 26th August, when I was there and went down the mine with Mr. Bryden, the manager. We were satisfied that the gob was heating from the steam and smoke that travelled along the return airway. Since that date no water has been taken out, and during the same time the old ventilating fan has been removed and a new one put in its place.

"Ventilation was good. I never found less than 39,000 cubic feet, and at the time of the stoppage there were 35 men and six mules.

"**No. 4 Pit, Wellington Colliery.**—This pit is about 1,000 yards east of No. 3, but on the top of the bluff, overlooking the Millstone Valley.

"Here, as in all the mines of this colliery, the men worked regularly on to 16th May, when they came out on strike, and little or no coal came out of the mine till August. At this time a few men started to work, and they kept gradually increasing. When I was down in December there were 120 men working.

"This pit is worked on the pillar and stall system, and is a very extensive mine. The coal is generally good, yet it is not without some faults. Here there is a connection with No. 3 pit, as well as the fan shaft.

"Ventilation is very good; motive power, a large fan on the up-cast shaft, worked by a large steam engine. This mine is ventilated on the separate split system; two main divisions at the bottom of the shaft, and this is again split further in in the workings, when, after going round all the works they meet again near the bottom of the up-cast shaft. The last time I was down, in December, I found that there were 108,000 cubic feet of air passing per minute for the use of 120 men and 20 mules. The mine is free from dust, having a regular system of pipes for watering where required.

"In addition to the overman and fireman, there is a staff, called the shot lighters, to examine and see that everything is safe before a shot can be fired. This staff use only safety lamps.

"**No. 5 Pit, Wellington Colliery.**—This is as yet the only pit of the Wellington Colliery that has railway connection with the Esquimalt and Nanaimo Railway, and also with the company's own system of railway to Departure Bay.

"In this mine, as in all the other mines of this colliery, the men worked steadily up to the 16th May, when the strike started, and this mine was also at a stand until August, when a start was made by a few, who have been followed by others, until, when I was there in December, there were 111 men at work.

"This is about the most extensive mine in this colliery. The coal is worked here from the east and west sides, also from an incline on the south, and a slope to the north. As this has been on the pillar and stall system (with the exception of part of the slope that is long wall), there has been much good coal worked here. Now at the south incline and west side, all the mining is at the pillars, which contained about two-thirds of the entire coal; but of course there are many of them by this time taken out. On the east side they are working in the solid coal, and also at the pillars. Down the slope to the north the long wall system works well, but it has to be closely attended to.

"In this slope there is also a considerable amount of work done on the pillar and stall system. Down this slope, and also in the east level, there is the prospect of having a very extensive mine for many years to come.

"Ventilation is very good. Motive power, a fan driven by a steam engine. When I was down in December I found that there were 116,560 cubic feet of air passing per minute; that is to say, to the west and south incline, 51,460; to the east side, 28,090; and to the slope, 37,010 cubic feet of air per minute; total as above, for the use of 111 men and 14 mules; this after being conducted well into the face and around the pillars, by brattice or otherwise. As all the above splits are within a few feet of the bottom of the down-cast, they do not get together again until they are close to the up-cast shaft.

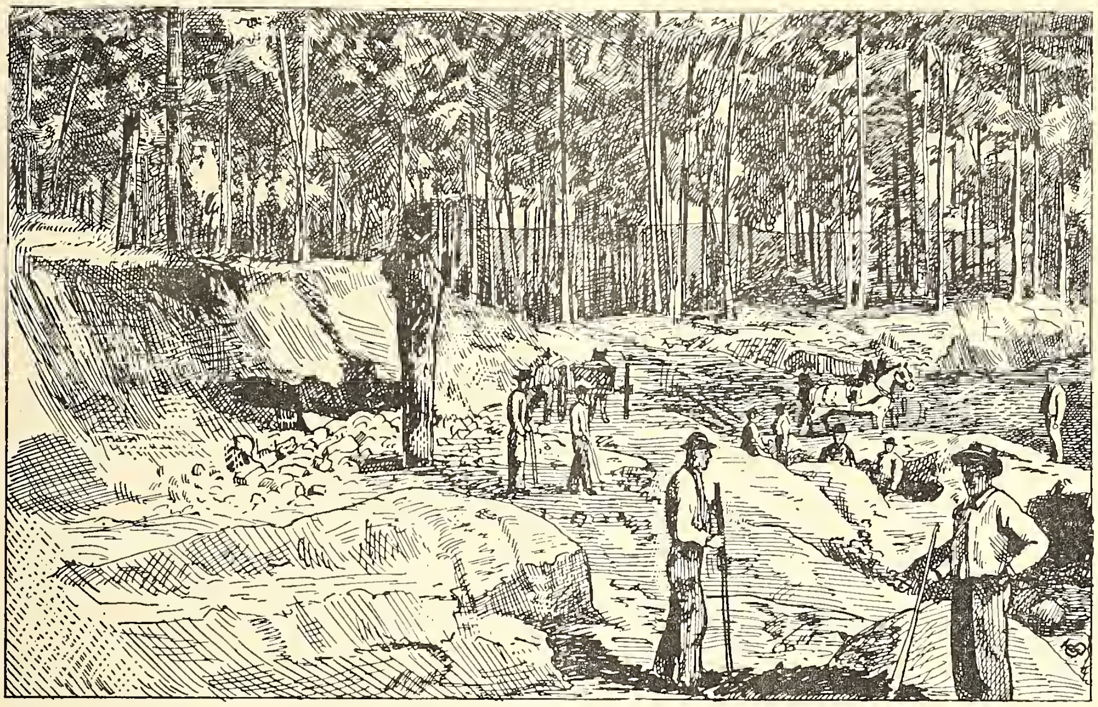
"This mine is also free from dust, and everything is arranged to keep it so, as there is a regular system of pipes for taking water along wherever it is likely to be required, with the mains along the levels and main roads, and smaller pipes leading therefrom to the stalls. In addition to the pipes there are sprayers connected to them at different places in the mine; the water coming out of them is so fine that the air carries the moisture along, so that there is no place it cannot reach—in the roof as well as the floor and sides. The pipes are connected with a large reservoir on the surface; the pressure being the depth of the shaft, 260 feet. Here they have also got their staff of shot lighters and examiners.

"**No. 6 Pit, Wellington Colliery.**—This is the same mine as mentioned in a former report, and about 900 yards east of the No. 4 Pit. Although working, the two shafts are only a short distance from each other; but that small piece is to remain, as it is not the manager's intention to connect those works for some time. This is going to be a very extensive mine, the coal almost lying flat, so that the working is all around the shaft, with a great extent to spread out. The coal is very good and hard, from six to eight feet thick, and worked on the pillar and stall system, which seems to be the best way of mining in this colliery, all things being considered.

"In this pit there has been the same drawback during the past year as has been in all the mines in this colliery, namely a strike, starting on the 16th May; and, as in the other mines, a few men went to work in August, who have been gradually added to, so that when I was down in December there were 55 men at work, with 20 men working in the afternoon.

"Ventilation is good; motive power, a fan on the Murphy principle, and when I was last down I found that there were 36,000 cubic feet of air passing per minute for the use of 55 men and 10 mules.

"This mine is ventilated on the separate split system, the two main divisions being at the bottom of the shaft, and conducted well into the face by brattice or otherwise. In this mine the company are at present restricted to a certain number of men, but they are trying with all haste to get connection with No. 5 Pit, in what is known as the East Level. The coal is good in both sides, and that may almost be counted on all through. It is expected to accomplish this in about a month or two. Then we may anticipate that the output of coal from No. 6 will exceed that of any of the other mines in this colliery.



Excavating Land Phosphates, Florida.

"**No. 2 Slope, Wellington Colliery**—There has been little or no coal mined or work done here during the past year, but the Company intend to resume work early in the spring.

EAST WELLINGTON COLLIERY.

"This property of the East Wellington Coal Company comprises two shafts, known as No. 1 and No. 2, which are in the valley of the Millstream. The shafts are about half a mile apart by a direct course, and are worked as one mine.

"In No. 1 Pit, coal only comes from a few men, and that from the west level, towards the No. 2. The coal is of the usual good quality, and hard, but the Company are much troubled with faults of one kind and another. On the east side they are now in a long distance which has proved one continuous fault, with a little black dirt here and there; but as this side is the greater part of their estate, they are determined to find out what is in it, and it is to be hoped that they will yet find a good piece of valuable coal as they have incurred a large outlay. I might say it has been up-hill work all the way.

"**No. 2 Pit, East Wellington Colliery.**—In this pit the Company have been working steadily all the year, except for a day now and then. The coal has kept good, and is in good demand in San Francisco, where most of it goes.

"This pit is worked on the long wall system, as has been the general way of working here. The roof is not quite so strong as it was some time ago, yet the mine works well, and the prospects for coal look good for the year we have now entered on, and I hope that expectations will not be disappointed, as the company are persevering and highly deserving of success.

"Ventilation, good; motive power, a fan on the Murphy principle. The fan is erected at the top of the No. 1 Shaft, and worked by a steam engine. When I was down in December I found that there were 23,000 cubic feet of air per minute for the use of 50 men and 7 mules, the air going down No. 2 Shaft, along the faces, except what escapes at different roads, but it is always caught up again at the face when it winds its way along the airway and out of No. 1 Shaft. There is very little gas given given off in this mine, and there is not much chance for it to collect, the old works being well filled up in every particular, and due precaution is used to prevent accidents.

UNION COLLIERY, COMOX.

"This colliery belongs to the Union Colliery Company. The mines are only a few miles from Comox. This, Company are working two veins of coal, two mines known as No. 1 and No. 2 Tunnels, or Adit Levels, going in on the hill side on the south side of the railway, and high above its level. Both of these levels are in about 600 feet, in good hard coal, and from two to three feet thick, overlaid by a strong sandstone. The mines here are on the pillar and stall system, and are very safe workings.

"Ventilation, good; motive power, a furnace, the air going in the travelling and hauling road, and returning by way of the face. There is no gas found in here, and it is free from dust, the mine being wet throughout.

"**No. 1 Slope, Union Colliery.** — This slope, which is now down about 2,000 feet, has not been extended any distance during the past year, but the levels from it to the north side have been working steadily the most of the year, that is by three levels with the stalls therefrom. The coal has kept good and very hard, and improving a little in thickness, being from three to five feet thick, with a strong roof. There are good indications to show that this seam of coal will improve in thickness, going to the north.

"Ventilation, good; the motive power, a fan on the Murphy principle, driven by a steam engine. This mine is also ventilated on the separate split system, going down the slope, and then going in the levels, coming around to the up-cast shaft by way of the stalls, so that the air goes down the slope to the lowest place there, then ascends until it again comes out at the top. The last time I was down I found that there were 24,000 cubic feet of air passing per minute for the use of 36 men. The mine gives off some gas, but not so much as to trouble the working of the mine when attended to. There is no dust in this mine, which is wet throughout.

"**No. 1 Shaft Union Colliery.**—This is the shaft mentioned in a former report. There has been much prospecting done here during the past two years, but there has been very little coal taken out. Now it is looking better, and the Company have the prospect of yet getting good workable coal, and it is hoped that they will do so after going to so much expense.

"**No. 2 Slope, Union Colliery.** — This is a new mine, started during the past summer, and about one mile north of No. 1 Slope. Here the coal was easy to get at, and now the Company have put a slope down 260 yards. The coal will average six feet thick. This coal is very hard, of good quality, and resembles the Wellington coal, and I may say that it is the most valuable strike of coal that has been made here by this Company, and is a good thing for them, also for the settlers of the extensive district of Comox, as well as for the Province in general. The Company have put down a series of bore-holes away ahead of this slope, which have proved the coal for a long distance.

PROSPECTING.

"**New Vancouver Coal Mining and Land Company, Limited.**—The workings from the No. 1 Shaft have now got through under the harbor, with one and three-quarters of a mile to haul the coal, this being about under Protection Island. There was a bore-hole started in this island about three months ago, and pushed with all haste. When at the depth of 588 feet coal was struck, and as it was gone through it proved to be a good workable seam. After going through this the bore-hole was continued, and at the depth of 650 feet from the surface another seam of coal was struck, which was thought to be a continuation of the first seam of coal that was worked on Newcastle Island, and also in the old No. 3 Pit, Front Street, Nanaimo. As the coal from both those places was of a good quality, there is no reason to think that it is not as good under Protection Island and the waters of Nanaimo Harbor. Near to this bore-hole the Company is preparing to sink a shaft, making every preparation to start, so as to lose no time, in order that they may be able to ship coal from this island at as early a date as possible. There is now a wharf built on the island for landing the machinery and materials.

"This Company put down a bore on Mrs. Frew's estate, which is the delta of Nanaimo River. Six feet of coal was passed through at a depth of 910 feet from the surface. They did not find the lower seam here.

"The bore-hole mentioned in a previous report as being down 1,460 feet was continued until they reached the depth of 2,220 feet, making the deepest hole in this district. No coal of any apparent value was struck, except that stated in my last report, namely, twelve feet of coal.

"**Comox.**—The New Vancouver Coal Mining and Land Company, Limited, have also been making some extensive researches in the Comox Valley. A powerful drilling machine was imported, and taken to Comox about mid-summer last. It was got to work as soon as possible, and continued drilling until a depth of over 2,000 feet was reached, and this was accomplished in less than six months. The results cannot be published at present, but it is sufficient to state that the coal measures undoubtedly extend into the north-westerly portion of the Comox Valley, but at a considerable depth. It remains to be proved whether the measures contain workable coal seams at a depth that will lead to their being worked. This Company are proceeding with other bores, and it would be a great benefit to the settlers of the important settlement of Comox if the Company should be successful in their enterprising exploration, as a home market would be provided for the settlers' produce.

"The New Vancouver Coal Mining and Land Company, Limited, are about to bore on Texada Island, where there are indications of coal measures. They are going to prove what is in them.

"The same Company are also starting to bore No. 4 in their North Field.

"In looking over this underground prospecting, you will see that this Company are exploring over a large area of Vancouver Island, and it is to be hoped that they will be successful in their undertakings, as it requires a great outlay of capital. The Company possess both the capital and the management necessary to insure success.

"There was other boring done in Rupert District of which I cannot give the results.

"**Oyster Harbor**—The diamond boring drills were removed from Oyster Harbor after considerable expenditure and an energetic search for coal.

"Negotiations, I am informed, are in progress for a renewal of operations, and it is to be hoped, in the interest of the Oyster Harbor Coal Company, as well as of the Province at large, that further exploration will prove successful.

"According to Mr. Richardson, the geologist, the whole of this section contains coal-bearing measures, which are a continuation of, and about the same formation, as we find at Nanaimo, but the covering seems there to be somewhat greater than it is hereabout.

TUMBO ISLAND COAL MINING COMPANY.

"This island, lying at the south-east entrance of the Straits of Georgia, has been prospected for coal by the above company for the past three years. There was one hole put down two years ago; then they started a shaft having a steam engine and air compressor. They worked away at this shaft until they got down over a hundred feet, when they quit work in the shaft, and put down another bore-hole near to the first one. This was put down through hard sandstone rock for about 220 feet. Here a bituminous shale was struck. This continued most of the distance, up to 325 feet, when coal was struck. I was at the bore-hole, saw and helped to bore and take out a considerable amount of coal, as well as some of the shale referred to. The coal that I saw taken out, the coal which I saw that had come out before I got there, and what was got out after I left, is enough to satisfy the Company that there is a large seam of coal under all this island, which the above Company owns. The above mentioned shale, when burned in a retort, was found to contain much gas, which burned with a clear white light. This may be very valuable for illuminating purposes. Altogether this Company has got a valuable property, and we hope, that when once it is opened out that it may be profitable for the Company, as well as beneficial to the Province at large. I am indebted to Mr. Charles Gabriel, who has charge of the works, for such of the above facts as are not within my personal knowledge."

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Noah's Ark as a Precedent in Mine Timbering—The timbering of a mine, necessarily a costly operation, is regarded as of very great importance; but sometimes the expense of this operation reaches a very large figure. In the Levant Mine, St. Just, the workings are very extensive, but for some reason the timbers only last a very short time, and their renewal keeps a force of men constantly employed. This gave rise to an amusing conversation at a recent meeting:—Dr. Searle enquired why did they not put in timber that would last until the Day of Judgment? "Have we" he added, "any man of sense connected with this mine?"—Captain Newton: Can you recommend any timber that will stand that?—Dr. Searle: Under chemical influence it will; would I be on the committee of this mine and not make it pay?—Dr. Quick: You are quite right; she will never pay any more.—Dr. Searle: You can sink timber under the sea and it will last for ever, and why not in Levant mine?—Mr. R. P. Couch: You recommend the process; don't speak generally like that.—Dr. Searle: What did Noah do with his ark? He pitched within and pitched without and kept the antiseptic influence out and all the people in the ark were dying from the same complaint as we have been dying of, the Russian influenza. (Laughter.)—Captain Newton: You were never in the ark.—Dr. Searle: If it was pitched within and pitched without—Several in the room, Pitch him out.—Dr. Searle: I have heard of dry rot in the pulpit, but I did not expect to meet with it in Levant account house.—Mr Couch: Did Noah hand you down a receipt?—Dr. Searle: Nature furnishes the prescription, and any man is a fool who does not carry it out.—Be this as it may, it is generally thought that Levant will ultimately receive a benefit from their present outlay, and that the agents will have an opportunity of dealing with a larger quantity of stuff than now.

The Copper Deposits of the Province of Quebec.*

Dr. R. W. Ells, Ottawa.

(Continued from page 71).

In what we have styled the third area, viz., that of Ascot and Hatley, we find a great series of deposits which have of late years proved to be among the most valuable in eastern Quebec, not probably so much for the amount of copper contained as for their adaptability for the manufacture of sulphuric acid. In this respect the ores of this most easterly belt differ widely from those of the two areas already described.

The variegated and vitreous ores are, for the most part, wanting; the bulk of the ore being a chalcopyrite, with much iron pyrites. The amount of copper contained is not high, averaging, for the great bulk of production, from four to five per cent., while in most of the ore there is an appreciable quantity of silver, reaching in some portions, as much as $25 to $40 per ton of ore, but yielding, on the average, from four to five dollars. A certain amount of gold is also present, but, as no attempts have yet been made to save this, the quantity is unknown.

These mines are situated in what we now regard as the Sherbrooke and Stoke Mountain anticlinal, and the rocks are chloritic, micaceous and talcose schists, with diorites. On this belt of rocks south-west of Sherbrooke and extending to the north line of Hatley, a large number of mines have been located, some of which have been worked for many years, while others, although containing valuable bodies of ore, have been idle for some time. In the township of Hatley the deposits appear to be much less numerous; the belt of schists becomes narrower, probably in part owing to the overlap of the black slates of the Cambrian system. The most southerly deposit of copper ore in this direction is near the upper end of Massawippi Lake, on the west side, on lot nine, range six. At this place there appears to be two kinds of rock, the soft blackish and bluish and pyritous slates being in contact with the hard quartzo-felspathic rocks of the mountain series. The contact is probably along a line of fault, and the ore, which is scattered through a width of eight to ten feet, is in the form of the yellow sulphuret, but the shaft being filled with water, the quantity could not be ascertained; a large amount of iron pyrite appears to be mixed with the copper ore. This is the Parnell mine. The only other mine located in this township is that on lot twenty-eight, range one, known as the Reid Hill mine. It has an elevation of 500 to 600 feet above the Massawippi River, and presents the appearance of six beds of the yellow sulphuret, with iron pyrite, in a space of a fourth of a mile in breadth. Similar ores appear on the lots to the west, on ranges two, three and four adjoining. Considerable exploratory work was done at this place, and a level was driven in about 200 feet below the outcrop of the bed, but no details of the workings or subsequent exploration are to hand. Beginning with this mine and passing into Ascot, there appears to have been an unusual development of this variety of ore, more particularly in that portion to the south-west of the St. Francis River, though large and very valuable deposits have also been discovered in the extension to the north-east of this anticlinal. The ores are apparently yellow sulphurets, and no less than fifty-five localities were at one time reported as copper-producing or giving good indications of the ore. In all, up to 1865, thirteen mines were operated, of which the localities may for the sake of reference, be briefly noted as follows, but since that date several others have been opened:—

The Clark mine—Lot 11, range 7.
The Sherbrooke mine—Lot 12, range 7.
The Albert mine—Lot 3, range 8.
The Eldorado or Capel mine—S.E ¼ lot 4, range 8.
The Victoria mine—N.E ¼ lot 4, range 8.
The Ascot mine—W. ½ lot 8, range 8.
The Parks mine—W. ½ lot 12, range 8.
The Short mine—Lot 14, range 8.
The Lower Canada mine—Lot 3, range 9.
The Marrington mine—N.E. ¼ lot 6, range 9.
The Hill mine—E. ½ lot 8, range 9.
The Belvidere mine—Lot 10, range 9.
The Magog mine—Lot 11, range 9.
The Griffith mine—Lot 3, range 11.

These are the mines mentioned in the report for 1866, and in addition, several other areas, not distinguished by any particular names occur, on which a greater or less amount of development work has taken place. Several mines have also since been opened, which promise well in view of the great present demand for sulphur ores. Among these may be mentioned the Suffield mine on lot three, range eleven; the Cillis, now the "Howard," on lot five, range eleven; the Hepburn mine, on lot seven, range nine; and the Moulton Hill mine, north of the St. Francis River, on lots twenty-three and four, range three. The width of the ore lodes, or beds, in this section is very great, in places being considerably over fifty feet, and the breadth of the ore-bearing rocks south of Sherbrooke, is about three miles; while from the Parnell mine, on the south, to the Moulton Hill mine, on the north, the distance is about twenty miles. Still further to the north, again, in Garthby, large deposits of similar ore have been reported. The first reference to the copper ores of this section is found in the report of the Geological Survey for 1847, where an outcrop of a vein in the fifteenth lot of the seventh range is mentioned as worthy of trial, which was found to contain, in addition to copper, small quantities of silver and gold; the latter, however, not in quantity to be of economic importance, but of interest as showing the possible presence of the precious metal in greater quantity in other veins of the vicinity. On the thirteenth lot of the same range, the continuation of this deposit carried copper pyrites in veins distributed throughout a belt of thirty feet of chloritic slates. This lode, on lot fifteen, was at the time traced for a distance of about fifty yards, but further to the south, from half to one-third of a mile, could not be found. When first opened it had a breadth of from ten to twelve inches. Up to 1858 no further interest appears to have been taken in these deposits, only two places being referred to in the report for that year, viz., that just mentioned and on lot nineteen, same range, where a small vein of copper pyrites was seen in a railway cutting near Sherbrooke station on the Grand Trunk Railway. In 1859 the Ascot mine was discovered by Thos. McCaw of Montreal, at Haskill Hill, and found upon examination to consist of a bed of copper pyrites mixed with iron pyrites, with a thickness of five or six feet, in a matrix composed of impure limestone and chloritic schist. This mine was, in the fall of 1863, purchased by an American company who erected furnaces for smelting the copper ore at Lennoxville. In the Geology of Canada, 1863, reference is made to but three mines in this vicinity, viz.: the Ascot, or Haskill Hill, the Belvidere and that first discovered and already described. The ore was similar throughout, and the breadth in the Belvidere lode was estimated at six feet. What was afterwards the Marrington mine on lot six of the ninth range showed a vein of from two to three feet at the surface, with a large proportion of iron pyrites. During the next two years a very extensive development in mining took place; a large number of mines were opened and a very considerable quantity of ore extracted. From notes kindly furnished me by Mr. T. McFarlane and by J. S. Hunter, now of Belleville, I am able to present a few items in regard to some of these, not already generally made public. The Clark mine is situated one mile and a half from the Lennoxville station, G. T. R., on lot eleven, range seven, Ascot. This was first opened in 1863, by Mr. Wm. Clarke, and was worked with more or less vigor for several years, principally by an American company, who took out a large quantity of ore. The work was carried on for the most part by means of open cuttings upon a vein said to have a thickness of eighteen feet (?) and containing three and a half per cent. metallic copper. This estimated thickness of ore bed is, however, doubtless exaggerated, since, on the most reliable authority, the thickness never exceeded seven to eight feet, and gradually decreased to eighteen inches. In addition to surface workings, a pit was sunk to a depth of forty feet, and a shaft for seventy-three feet. Further explorations were carried on in 1866, but without success, and in that year the mine was sold at sheriff's sale. No returns as to quantity or quality of output are to hand, and the mine has apparently remained idle since the date mentioned. The Sherbrooke mine immediately adjoins that just described to the south, and is traversed by the same lodes as are found in the Clark mine. It has been quite extensively explored on the surface, though not yet opened up by underground exploration. Several valuable deposits of pyrites are reported on this property; one of which is said to have a thickness of eight feet, while another was stated to be no less than seventy feet in width.(?) Assays by several parties gave from $4 to $5 of gold, $11 per ton of silver, and from 30 to 40 per cent. of sulphur.

A group of three mines, situated on lots three and four, range eight, and lot three, range nine, are worthy of special notice, not only from their early history, but from their great and growing importance at the present time. These comprise what were formerly known as the Lower Canada, or Hartford, now the Eustis or Crown mine, the Capel or Eldorado, and the Albert; the latter being now owned by the firm of G. H. Nichols & Co.

The Capel mine was so called from the name of the original owner of the property, Mr. Geo. Capel, and in 1863, chiefly through the agency of Mr. W. S. Hunter, three men, Mr. Hunter, Mr. Pierce and Mr. Capel, formed a company to develop the property on lots three and four of range eight. These gentlemen spent from eight to ten thousand dollars in exploratory work, and, finding the results satisfactory, divided the property into two portions; the eastern area, on range nine, being styled the Prince Albert mine.

The property was soon acquired by Montreal capitalists by whom mining operations were commenced, and have been carried on to the present day though under change of ownership and management. From the Montreal firm the property passed into the hands of Taylor & Sons, of London, who adopted the Henderson process for the extraction of the metallic copper. This, however, after a thorough trial, failed to give satisfaction, and the mine was closed. The property subsequently changed hands, and was finally purchased by Messrs. G. H. Nichols & Co., an American firm of ability, by whom the ores have, for the most part, been shipped to the sulphur works at New York or vicinity, for the manufacture of acid. Within the last three years, however, a somewhat extensive plant has been erected at the mine for the manufacture of sulphuric acid on the spot, as well as for that of superphosphate. Smelting works have also been still more recently started for the production of matte. The success of the present company is no doubt largely due to the saving of the sulphur and other by-products of the ore, in which the profit consists.

The depreciation of the copper market at the time of the former management, combined with the loss of the sulphur, was such that expenses apparently could not be met. The deposits at the Albert and Capel mines are doubtless a continuation of that found to the south-west at the Crown mine, formerly the Lower Canada. There the ore bed is an immense, but somewhat irregular deposit of chalcopyrite, with much iron pyrites, yielding an average of four to five per cent., some of the ore being very rich, and in addition contains an appreciable amount of silver; the lode varies in width from four to over fifty feet, and has been worked to a depth of over 1,600 feet. At the Eustis or Crown mine also, smelting works have been erected, in which a large amount of matte is made, the sulphur in this case being wasted, but a very large proportion of the ore still goes in the raw state to the sulphuric acid works in the vicinity of New York, while the residue is treated for copper at the smelting works at Bergenport, New Jersey. The owners of the latter are the Eustis Mining Co. The ore at this mine apparently occurs conformably with the bedding, the irregularities in size being due to local thickening of the ore mass. Dykes of diorite are met with in the different underground workings, and can also be seen at the surface in the immediate vicinity of the mines. The rocks containing the lode are schists, often highly micaceous and talcose, but generally chloritic, which are traversed by numerous quartz veins. The ore is delivered on the railway, about half a mile distant from the Albert mine, by an elevated cable tramway, carrying the ore buckets, and from the Eustis property by a gravity tramway to the track, where it is dumped directly into the cars. From several assays of this ore the quantity of sulphur is found to vary somewhat, but averages 38 to 40 per cent. :—

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* Mineral Resources of the Province of Quebec, 1890.

Iron	35
Copper	4 to 5·

Silver, about one ounce per unit of copper,
say 4 ounces per ton.

The Lower Canada mine, or the Crown mine now so-called, was discovered in 1865. For two or three years thereafter it was worked for copper alone, but subsequently for copper and sulphur. This mine is well described in the Geological Survey Report for 1866, from which the following abbreviated extract may be made as illustrating the character of the workings and of the ore at that date. The strata for a distance of 1,600 feet dip S. 30°-40° E. ∠40°-60°, and in this distance five shafts have been sunk in micaceous schist, to the south-east of a dolomite band, and to all appearances in the same bed of ore. In shaft No. 1, the ore is ten feet thick, the lower four feet of which is apparently an almost compact mass of the yellow sulphuret of iron and copper, with a yield from this portion probably of eight per cent. of copper. Upon this are two feet of similar character, but yielding only about five per cent. of copper, and the upper four feet contain iron pyrites alone.

No. 2 shaft is 125 feet south-west of this, sixty feet deep, and the ore bed is four and a half feet thick; the lowest part is similar to that in the first shaft, but said to yield fifteen per cent. copper, while the remainder yields only three per cent. The ore bed, as shown in the shafts Nos. 3 and 4, sunk to a depth of 75 and 132 feet respectively, is similar to that in No. 2, but in No. 5, sunk 90 feet, the bed is six and a half feet thick and vertical for 80 feet from the surface, thence dipping S. 40° E. ∠40°-50°. In the vertical part it contains only iron pyrites, but below this sufficient copper pyrites becomes mixed with it to cause the bed to yield between three and four per cent. of metallic copper. Other bands of copper ore occur in this lot, on both sides of shaft No. 1.

Subsequently to the date of this report mining operations were vigorously carried on, and in addition to the copper, which was originally the sole object of the enterprise, the large amount of sulphur contained in the ore was utilized for the manufacture of sulphuric acid, both in Canada and the United States. Up to June, 1869, about 20,000 tons were smelted to 40 per cent. regulus on the spot.

A very large quantity was shipped to acid works, the amount of sulphuric acid obtained being stated at one ton of 65 per cent. acid to each ton of ore.

The yield of ore from these mines at present is very large and apparently annually increasing. The output for 1889 taken from the returns of the CANADIAN MINING AND MECHANICAL REVIEW, was, from the Eustis mine, 34,089 tons, including 1,773 tons matte, and from G. H. Nichols & Co., 36,000 tons. Of some of the other mines alluded to in the list given in a preceding page, but little can here be said. On some of these a considerable amount of exploratory work was done and the promise of good sized ore beds seemed good, but, in most cases, this exploration was not pushed to a depth sufficient to decide as to the actual value of the property. This can be easily seen by reference to the great mines of Capelton, and by a comparison of the enormous size of the lode in the lower levels, with the comparatively limited extent at the surface. Among others, not noticed in the list of 1866, may be mentioned the Suffield mine, on lot two, range eleven; the Hephurn mine, on lot seven, range nine, at which a large amount of exploratory work appears to have been done, and the Cillis mine, on lot five, range eleven, which has, within the last year, been re-opened to a greater depth, and the ore has been found to increase in quantity and quality so greatly that it is now considered an exceedingly valuable property. It has been purchased by an American syndicate and will be worked.

From notes obtained by Mr. Willimott in 1882,* the Hephurn mine was then being worked quite extensively. Like the Ascot and Suffield mines, it was the property of the Sherbrooke Mining and Smelting Co. A shaft was sunk to a depth of 156 feet, and at sixty feet a level had been driven for thirty feet, from which a north and south cross-cut was made. The latter was carried 110 feet, at which distance a bed of yellow sulphide twenty-four feet thick was cut, averaging about seven per cent. metallic copper. The north cross-cut was carried ten feet, where another bed of yellow ore was cut, said to be twenty-seven feet thick. No ore has been raised, the object of the company being to develop a large reserve.

About twenty men were employed at the mine. Work at this mine was shortly after abandoned. The quality of the ore in the dump, seen in 1885, looked well. Of the Suffield mine, Mr. Willimott says: "A shaft has been sunk 200 feet; at the depths of eighty-five feet and at two hundred feet, levels have been driven to the east, the former 300 feet and the latter 100 feet, connected by a ventilating winze."

The amount of exposed ore is reported at about 40,000 tons, of which 3,500 to 4,000 have been taken out with the intention of concentrating and smelting at the mine.

At this mine the drilling was done by compressed air driven by an engine of sixty horse power.

The ore resembled that from the Capelton and Hartford mine, an assay of which was made by Dr. Harrington in 1877, yielding 75.03 ounces of silver to the ton. Assays of the Suffield ore, by John Massey & Co., London, England, gave percentages of silver, varying from eight ounces to 235 ounces per ton, and from four to twenty-nine per cent. of metallic copper.

In the area north of the St. Francis, deposits of ore occur precisely similar to that of Capelton, and in similar rocks. What has proved to be a very valuable deposit was found about three years ago by Mr. Burke, the owner of the land, on lots twenty-three and twenty-four of the third range of Ascot, which has since been somewhat extensively developed, and purchased by the same syndicate which acquired the Cillis mine. The bed of ore which dips with the slate south-easterly at an angle of 45° to 50° was found to rapidly increase from four to six feet at the surface, to a reported thickness of not far from fifty feet, at a depth of seventy feet, revealing an enormous body of ore. This location was revealed by the uprooting of a tree, and is in the direct course of the Capelton deposit, which it so much resembles. In view of the fact that these several ore beds which are found over a breadth of some three to four miles, resemble each other very closely, and from the crumpled and overturned character of much of the strata in which these are contained, it seems most reasonable to suppose that the greater part of these mines are located upon different portions of the same lode, repeated by folding from place to place, and that as large and valuable deposits of the ore have been found at widely separated portions of the same vein, both in the southern and northern portions of the township, and almost equally valuable deposits are known in the more western portion of the belt, as at the Cillis mine, it may be very safely predicted that the real value of many of the mines which were opened twenty-five years ago, and speedily closed. has never been ascertained, and that other masses of ore, of equal importance to those so long worked, will at some not distant date, by careful prospecting, be found. Much of the failure of twenty-five years ago was, doubtless, due to the speculative character of the work done. Mines were bought and sold on the flimsiest sort of evidence as to their value or worthlessness; often on samples which were obtained from an entirely different location from that represented. The growing importance of these ores as a source of supply for sulphuric acid is being very fully realized by the men interested in this industry in the United States; their superiority over most of the ore there found, for this purpose, being acknowledged. There are yet, in this eastern belt, many places thickly covered by forest growth, the prospecting of which is a difficult matter, but of the many mines already opened and abandoned it is highly probable, as in the case of those now worked, that deeper and more scientific testing would change the aspect of things greatly for the better.

Further to the north, in Garthby, a considerable deposit of pyrites is found on lot twenty-two of range one. This deposit is described in the Geology of Canada 1863, p. 733, as "a large mass of iron and copper pyrites subordinate to the stratification of the enclosing rock, which is a calcareous serpentine, dipping to the south-east at an angle of 50°. The extent of the deposit has not been determined, but there appears to be a breadth of about twenty feet, in which the two ores are more or less mingled with rock. Large masses of the mineral consist of a fine-grained iron pyrites, without any copper, while in other portions the ore is such an admixture of copper pyrites as to afford eight per cent. of the metal."

The ore at this place occurs in rocks differing in age from those of the area just described, being more closely allied to the deposits of Bolton and Potton. The first opening was made by Mr. J. B. Coulombe, in 1860, and was nine feet long, five feet wide, and said to be sixty feet deep. No work was done on the property after 1861. An analysis of the iron pyrites apparently free from copper gave iron 42, sulphur 48, copper 1·1, silica 8·9. This property is about four miles from the Quebec Central Railway, and recent explorations during the past year, in the southern part of the area, are said to have developed a large body of ore, the measures being traced into South Ham for a distance of three miles, but no definite information can be obtained on this point.

In the townships of Ham and South Ham, several mines were also at one time started, but these, apparently from an insufficiency of ore, have long since been closed. Among these may be mentioned the Nicolet Branch mines on lot twenty-eight, range four, where the variegated and vitreous ores were found scattered through a band of dolomite and chloritic schists, over-laid by glossy black slates.

The ore is found in small veins only, disseminated through the rock, and by exploration over several hundred feet several tons of rich ore were obtained. On range B, lots thirty-three to thirty-six, explorations were made; on the right bank of the Nicolet River on similar ores in green rocks, like the last, but without success, only small quantities apparently being found. In South Ham, in the serpentine and diorite rock of the south and east side of Nicolet Lake, small deposits, mostly of the yellow sulphuret, occur on lot twenty-two, range one, old numbering, or lot forty-four, range one, new numbering. This was styled the Nicolet Copper Mine. A small amount of exploratory work was also done on lot fifty-two, range two, new numbering, but no returns are to hand. Further north, in the township of Thetford, copper ore has lately been reported by Dr. Jas. Reed as occurring on lots three, four, five and six of the first range, and on lot fifteen of the second range of Leeds, as well as lot nineteen of the second range of Thetford, but the quantity and character of the ore is unknown, as not yet explored.

The Asbestos Industry in 1890.

In the Summary Report of the operations of the Geological Survey, just issued, Dr. Ells reviews last year's operations in the asbestos districts as follows:—

"The asbestos industry shows also a great increase, both in the amount of the output and in the prices obtained for the raw material, and probably not less than 8,000 tons have been shipped during 1890, though the complete returns are not yet in. The price of No. 1 has risen rapidly from $100 to $125 to $200, and even $250 per ton, with a further tendency upward. Several new mines have been opened and the work at the old mines has been pushed with greater vigour. The increase in the output is largely due to the fact that improved machinery is now employed in all the pits, in some of which compressed air for the purposes of drilling and hoisting is used; others use steam direct, the former being considered the more advantageous, owing to the ease with which the drill holes can be kept clean. Preparations are now being made for removing the dumps from their present sites to the barren ground near the Thetford River, and it is estimated that the crushing and cobbing of these will amply repay the cost of removal. The necessity of employing machinery for the purposes of crushing and cobbing for the smaller veins at least is now recognized, and is being put in operation at the American and Anglo-Canadian mines at Black Lake. In addition to the mines already described in former reports, several new areas have been opened on the west side of the Quebec Central railway. While the veins at all these occasionally show good fibre, it is evident, upon examination, that the rock nearer the river and on the low ground does not yield such fine asbestos as in the mound where the mines were first opened. In Coleraine, also, several of the new companies which began operations last year at Black Lake, have abandoned their locations, owing, probably, to an unfortunate choice of ground, while some of the Thetford companies—notably King Bros., A. S. Johnston and A. H. Murphy—have opened new areas here and found good veins. Among others, Dr. James Reed, on lots 27, 28, 29, has erected a first-class mining plant, with air compressors, for carrying on work on his areas, on which considerable work has been done during the past season, mostly by the contract system. On the west side of the upper part of Black Lake, near the inland line, Messrs. Grundy, Steel & Co., of the Beaver Mining Co., have begun work in Range B, Coleraine, but the work so far has been mostly exploratory. Numerous small veins and some of fair size have been found, but their value cannot yet be definitely pronounced upon.

"Great activity on the part of prospectors is manifested throughout the whole of the Serpentine belt of Thetford, Coleraine, Broughton and Wolfestown. Several finds of valuable areas are reported, none of which, however, in so far as careful inquiry could determine, are of very great importance. An interesting point discovered during the past year is the fact that the walls of so-called barren rocks encountered in nearly all the mines, owing to the presence of faults, and formerly supposed to be worthless, are now in good ground, the barren portions extending but a short distance. This is what might have been expected in such areas, the fault being only local and merely displacing masses of presumably equally rich serpentine. The serpentine areas of the south-western portions of the province have not yet disclosed the presence of workable veins of asbestos in quantity, with the exception of the mine at Danville, owned by Mr. Jeffrey, where some fine veins have lately been discovered. The Brompton Lake mine, which is the most southerly worked to any extent, has been opened to a very considerable depth, and a large amount of money has been spent; but the prospects for workable veins in the lower workings are no better than at the surface, and no returns have yet been made. About Orford Pond on the south side of Orford Mountain, and near Long Lake, at the northern extremity of the same ridge, excavations have been made in thin and irregular seams a fourth of an inch, and in the road west from Knowlton Landing to Bolton Pass, in the serpentine band to the east of the Missisquoi River, some exploratory work has been done without finding asbestos of any economic value, and in so far as yet ascertained this portion of the province does not present favorable indications for profitable asbestos mining."

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* See Geol. Sur. Rep., 1882-3-4.

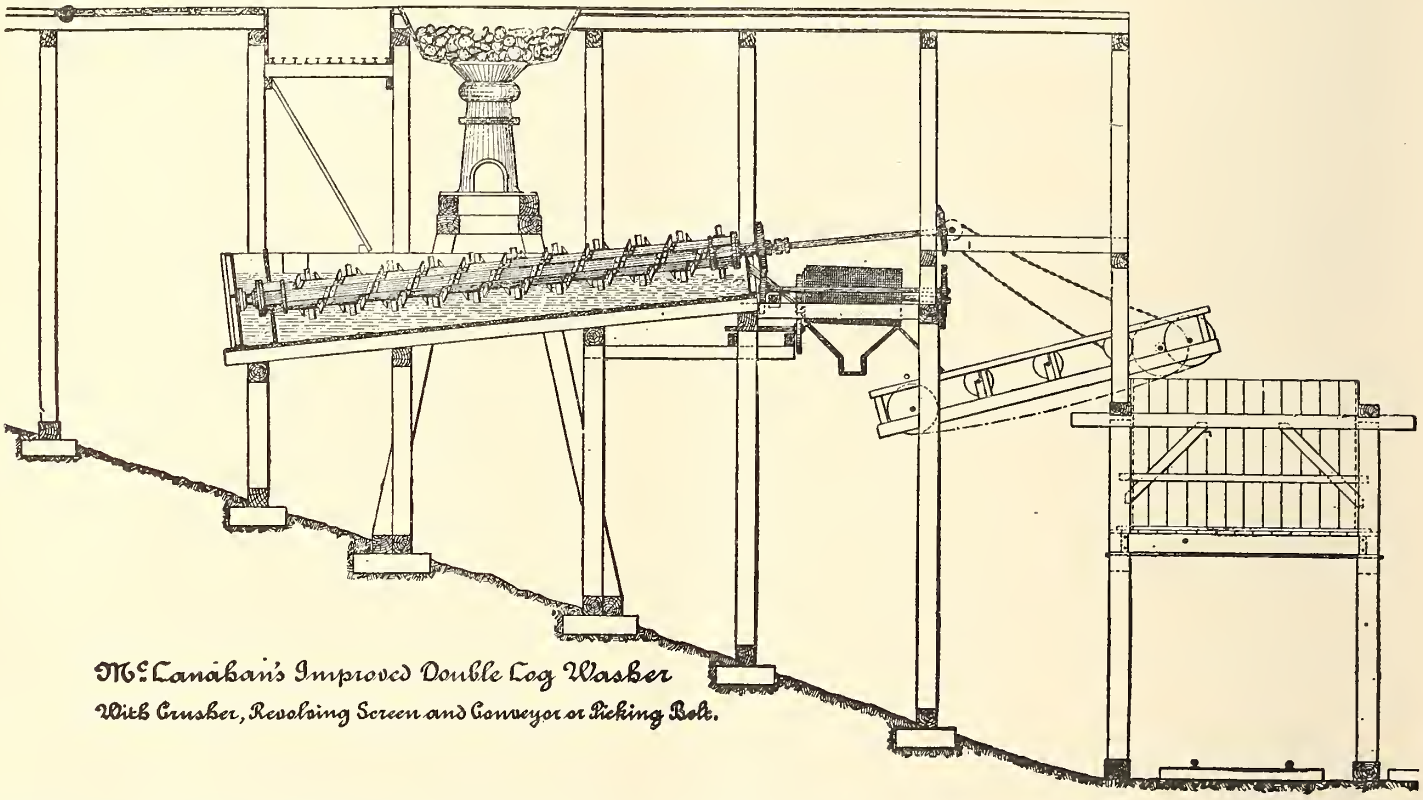
Iron Ore Concentration.*

Concentrated iron ores are usually considered as those which have passed through sizing and jigging or sizing and magnetic separating processes, and the term is more commonly applied to magnetites than to hematites, but we may properly consider any method of beneficiating iron ores in this discussion.

In other words, we may refer here to any means of increasing the percentage of iron in an ore by separating from it all or a part of its gangue under the general caption of concentration, and therefore in this category, washing or jigging processes may be considered. The roasting of iron ores is to a certain extent a concentrating process, but their purpose is seldom one of separating the gangue from the ore, but rather of driving off moisture, sulphur, or carbonic acid; and this treatment is generally recognized as that of "roasting or calcination." The system of washing brown hematites approaches in results those obtained by jigging and may fairly be considered under the general head of concentration.

The use of the washer has developed more largely in Virginia, Georgia, Alabama and Tennessee, than elsewhere lately, but the forms principally employed are either the shaft or the cone washers. The shaft washers are single or double, the latter being preferred, and consist of one or two logs of wood iron bound and fitted with blades; these logs revolve in a trough in which the ore and water are placed, the revolving blades cutting up the clay lumps, and forcing the ore up the inclined bottom of the trough, the water carrying away the clay to suitable settling reservoirs or mud dams.

In some instances iron shafts have been used in place of logs, and the most approved arrangement is to have paddles which slip into sockets secured to the shaft, in place of securing the blades directly to the shaft. The accompanying illustration shows an arrangement of washer of which a number have been erected in central Pennsylvania, in Virginia, Tennessee and Alabama, by the Gaysport foundry, of Hollidaysburg, Pa. The ore as brought from the workings is discharged from mine cars on a "grizzly" through which all but the lumps pass into the trough. These lumps are fed into a crusher and from this also drop into the trough, unless it is desired to ship them without washing. As, however, considerable clay adheres to or is enclosed in the nodules of brown hematite ore, the washing of the broken lumps is advisable. As the blades cut or push the ore forward in the trough, it is met by a stream of water and the clay is washed away, the ore passing out at the upper end of the trough into a revolving screen in which a final rinsing by water takes place, and in which the finer ore or sand is separated, the coarse ore passing on to an inclined conveyor which serves as a table from which any foreign material may be hand-picked.



McCanahan's Improved Double Log Washer
With Crusher, Revolving Screen and Conveyor or Picking Belt.

In some instances all the fine ore which will pass through one inch round holes is, after washing, treated in jigs, as described in the *Journal*, vol. viii., p. 42, when discussing the process used at Iron Mountain, Missouri.

An advantage claimed for this washer is, that it embraces the principal feature of the submerged log-washers, logs being placed on an incline of from two to three feet in their length, thus practically submerging the logs nearly one half their length, the back end of the washer-box being 4 feet high. The logs are 17 to 18 inches in diameter, generally 30 feet long, covered with iron their entire length. The teeth are made with detached bases, the bases being secured to the logs so that the chilled teeth may be renewed without disturbing the bases. The logs are provided with flanged gudgeons, the back or lower gudgeon being protected with a chilled thimble, which runs in a chill step or bearing.

The logs are both driven from the front or discharge end by spur and bevel gearing. Two or more washers may be set side by side, all driven by the same main line shaft, with countershafts to each washer, this countershaft beng fitted with a shifting clutch so that any one machine may be readily stopped without interfering with the operation of the others.

A circular issued by McHanahan and Stone, descriptive of jigs, makes the following statement:—

"Many furnace men have never attempted to estimate the cost of smelting the foreign material contained in their ores. It is not unusual to find furnaces using ore containing 20% of foreign matter that might be taken out by a good jig, and it will be generally found to pay to use jigs if only 5%, or less, of foreign matter can be removed. In estimating the cost of using low grade ores in a blast furnace, not only the cost of coke, time and furnace labor required to smelt this barren material must be considered; but the cost of freight, handling and storage, and taking care of increased amount of cinder. It also decreases the available capacity of the furnace.

"As the commercial value of ore becomes generally regulated by its analysis, it will be found necessary to give more thought to the proper dressing of the siliceous hematites, and it must be remembered that the value of ore depends, not only on the metallic iron, but also on the limit of silica.

"The market value of ore varies in the different parts of this country more than the price of pig iron. Formerly but little difference was made in the price of high and low grade ore, but gradually all ores are being held at more nearly their real value, and the difference in value varies with cost of coke, labor and all other expenses outside of ore, and if it is possible to increase metallic iron 5 units, and secure a corresponding decrease in silica by the use of jigs, they would prove profitable investments." The same authority suggests the following general rule for determining the value of brown hematite ores at the mine:—

"*Rule.*—For each unit of increase in metallic iron add one-twentieth of one cent. per unit to selling price; and for each unit that silica is lowered, add one-tenth of one cent to selling price. Thus, if ore before jigging analyzes iron 42, silica 22, and sells for 3 cents per unit or $1.26 per ton,—if this ore is improved by the jigs to iron 50, silica 12, the increase in iron, 8 units, at one-twentieth of a cent per unit, equals four-tenths of a cent, and decreased silica 10 units at one-tenth cent per unit, equals 1 cent; making total price for jigged ore per unit 4.4 cents. Fifty per cent ore, at 4.4 cents per unit, equals $2·20 per ton, an increase of 94 cents per ton."

The following analyses of brown hematite ores before and after jigging are presented:—

Ore before jigging—metallic iron, 31.72. Insoluble residue, 48.82.

Same ore after jigging—metallic iron, 51.465. Insoluble residue, 15.3.

Ore before jigging—metallic iron, 43.20. Insoluble residue, 26.40.

Same ore after jigging—metallic iron, 50.59. Insoluble residue, 16.53.

Where phosphorus exists as apatite it is often reduced by washing and jigging the ore, thus bringing some non-Bessemer hematites nearer to, or within the Bessemer limit.

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* Journal of the Charcoal Iron Workers.

We had hoped in this issue to have given late results of concentration by magnetic separators, but at the request of parties interested we defer this data until the average of longer runs can be given. We may, however, note that considerable progress is being made towards placing concentrates on the market as a regular source of iron ore supply, and some excellent results have been obtained.

The new plant at the Croton Mines, New York, is now in operation, using the Buchanan and Croton Magnetic Separators; the concentrating works near Bechtelsville, Pennsylvania, is now separating a very lean magnetite by the use of the Edison Separator, and at Michigamme, Michigan, the Wenstrom Magnetic Separator is being worked to utilize a large dump pile. A large concentrating plant is in course of erection in New Jersey, two others are approaching completion in northern New York, and a third is being remodelled in southern New York.

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A New Oil Separator.—Letters patent have been issued to Mr. C. J. Stock, Superintendent of the Northwest Natural Gas Company, in Ohio, for a new automatic separator, that is designed to separate oil or other fluids from gas. The separator is attached to the line that leads from the well, and is so constructed that no liquid passes in the gas line. It will work readily on any pressure from 1 to 500 pounds. Mr. Stock has been experimenting with the invention for the past two years, and has at last attained success. He has several of them in use in the Dayton field; one by the city of Tiffin; at Bairdstown, and several by the Northwestern in Hancock County. The one at Bairdstown was timed recently, when it separated and threw out 55 gallons of oil in 30 minutes. The capacity of the separator is from 75 to 100 bbls. of fluid per day.

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Convention of Ontario Mining Men—Important Resolutions Passed.

At the convention of Ontario mining men called by the Canadian Institute, which met in Toronto on the 31st ult. and 1st inst., Mr. W. Hamilton Merritt was elected chairman and Messrs. G. Mickle and T. A. Gorham associate secretaries. The delegates present were: Representing the Canadian Institute, Messrs. Allan McDougall, Carpmael, Pierce, Bain, David Boyle, H. Merritt, A. Blue, Wm. Ince, Dr. P. H. Bryce, J. Notman, R. W. Phipps, T. R. Clougher, Alex. Rankin, A. Harvey, A. E. Elvins, Chas. Livey, Rev. J. F. Latimer, R. Dewer; Lake of the Woods, W. Young, A. Rankin, C. S. Morris, A. S. Thompson; Sudbury, F. L. Sperry, W. J. Skynner, T. R. H. Ahn, Geo. A. Shaw, R. Gordon, A. McNaughtou, Geo. Dunstan, J. L. Nichols, E. J. Jarvis, J. A. Wright, J. A. Harvey; Port Arthur, T. A. Gorham, T. Marks, W. H. Hunter, W. L. Bell, Robert Martland, W. H. M. Pailand; Perth, W. C. Caldwell, E Elliott; Ottawa, J. M. Clark; Thunder Bay, Peter McKellar, John McKellar, Capt. J. T. McAdam, James McGee; Algoma, P. J. Loughrin, D. Blain, A. H. Barry, M. J. Paterson, Peter Thomson; Marmora, County of Hastings, W. Kelly, H. T. Strickland; Haliburton County, James M. Irwin, Chas. J. Pusey, T. Shortiss; County of Leeds, Robert O. Jones.

The following resolutions were passed:—

"That to secure the advancement of our mining interests as well as to encourage and foster this promising industry, this Convention is of opinion that the most important step is the establishment of a Provincial Department of Mines, to be presided over by a responsible Minister, whose duty it should be to set in motion such machinery as would lead to the establishment of our mining and metallurgical industries on a firm basis. While some may think that a Bureau of Mines, presided over by one of the existing Ministers, would answer our requirements for the present, it appears to this Convention that nothing less than the establishment of a separate department will meet the exigencies of the case or properly serve the public interest, and that every year the establishment of such a department is delayed will seriously retard the due development of our mining resources.

"A Bureau of Mines will cost as much as a department, and cannot render efficient service. A bureau lacking executive power and having no will of its own could not grapple with the complicated and important questions involved in the development of our mining resources.

"A responsible head is needed to deal with the scientific development, the educational advancement and the practical measures of legislation which in the near future must be initiated.

"This Convention heartily endorses the action of the Canadian Institute in calling it together for the purpose of considering the establishment of such a department.

"That a Provincial museum would materially assist mining and metallurgical development in the Province as advocated by the royal commission, and for the reasons given in the report.

"This Convention remarks with great satisfaction the publication of the royal commission on the mineral resources of Ontario, which supplies a long felt want in the mineral and metallurgical reference literature for the Province.

"This publication has made more apparent the great need of a concise and complete volume on the mineral resources of the Dominion. This Convention therefore takes the opportunity of endorsing the petition presented by the Canadian Institute to the Dominion Government, which set forth that, 'in the opinion of your memorialists, it would be of the utmost benefit to those interested in mineral and metallurgical development were a compilation made of all information relating thereto in connection with the forthcoming census, supplying by that means the gap which has occurred since the publication of Sir Wm. Logan's summary of reports in 1863, since which no publication has been issued relating solely to mines, minerals and metallurgical operations.' And this Convention hereby resolves, that it would be in the best interests of mining and metallurgical development in the Dominion, for the Government to appoint a special commissioner in connection with the approaching census enumeration, for the purpose of carrying out the prayer of the Canadian Institute. And further resolves that a copy of this resolution be sent to the Premier, Sir John Macdonald, and to the Minister of Agriculture, at Ottawa.

"The Convention wishes to comment on the insufficient encouragement hitherto given to the prospector and the preliminary worker in the mining districts. The farmers are supplied with experimental seeds, specimens of fruit and shade trees, the germinating qualities of their grain are determined without charge, letters of enquiry are carried free and answered fully, experimental farms and travelling professors give them satisfactory instruction, so in order that the mineral resources of the Province may be successfully and economically developed, it is desirable that a scheme for the practical and scientific training of those engaged in mining should be adopted by the Government through the establishment of local schools of mines. Lectures by competent persons should be given in the mining settlements, and ready means should be afforded municipal bodies for establishing and aiding such schools and other means of instruction.

"That those portions of the Province containing unsold mineral lands in quantity, should be set aside as mineral districts, due reference being had to portions therein suitable for settlement by farmers, and to necessary reservation for lumbering territory. That the Government be recommended to proceed as rapidly as possible with the completion of the system of township surveys in what is now the unsurveyed territory of the Province, said surveys to accurately describe the topography of each particular township, and if possible the geological formation to be added, the stakes to be of a permanent character, the townships first surveyed being those which are most likely to attract explorers and purchasers; and that all surveys of mineral lands be made by theodolite and not by the compass.

"There should be a local agent in each mining district, whose duty it should be to receive and number consecutively all applications for mining lands within his jurisdiction and to keep the same for public inspection; to facilitate such inspection he should keep in his office in a conspicuous place, easy of access, a list showing the number of each application, the date upon which it was filed, as well as the date of the discovery to which it relates, and the date of the expiration of the same under any regulation relating thereto, together with the name of the applicant or applicants and their address, and having a reference by number to a description of the land so applied for on a map or plan, which he should also keep, showing the area covered by each application, which plan should also show all land patented and the date of the issue of the patent and the name and address of the patentee.

"That this Convention emphatically pronounces against all Provincial taxation in the shape of royalties and ground rents.

"That liberal grants should be made for the building not only of highways, but railways throughout the mining districts. There are millions of acres of Provincial lands which are wholly inaccessible by any other than a canoe route and cannot be mined without roads. The judicious and liberal expenditure of money in roads, and in some cases where experience has proved the value of the district, in railways, would tend not only to promote the actual mining, but the additional sales caused by such expenditures would more than reimburse the Province for its outlay, besides adding largely to its population and wealth. That this Convention heartily endorses the policy of the present Government in aiding railways in new districts, and while fully recognising the liberal aid already extended for the opening up of the new districts both by railways and colonisation roads, the Convention would urge that a still more liberal policy should be pursued.

"That the present system of taxing mineral lands in districts without municipal organisation be continued; but the system of selling for arrears of taxes be discontinued, and, instead, that when the lands are two years in arrears they be advertised, and if the taxes and advertising cost be not paid within one year from the date of such advertisement that these lands revert to the Crown and come then under the then existing regulations as if they had never been sold. Your committee finds that the amount realized by the Government for unpaid taxes, while not large at any time, is in many cases sufficient to cover many thousands of acres of land which is then bought at the sale for a comparative trifle by speculators, who neither sell nor improve their properties; thus the reselling at the Government price of even a portion of these lands would more than cover any loss of revenue that might ensue.

Proposed by MR. CONMEE: "Whether the principle should be recognized that the prospector be allowed to stake out his claim on surveyed and unsurveyed territories.

By MR. CONMEE: "Is it, in the opinion of this convention, in the interests of the mining development of this Province that there should be any development work required before the lands should be patented, except where the land has been bought and paid for forthwith?

"That whereas cases have been represented to this Convention that excessive rates have been demanded by the railways for carrying ore, this convention is of opinion that it would be in the best interests of mineral development that the lowest possible rates should be charged, and that it would be in the public interest that a railway commission with power to regulate rates should be created, and this Convention asks the co-operation of the mining and metallurgical interests of other Provinces in this direction.

"That where in any location development work has been performed by the locatee, a rebate of price should be allowed and an extension of time for payments.

"This Convention believes that in the pending negotiations for a treaty of reciprocity with the United States, a free market for mining products would be to the advantage of both parties, and greatly tend to the development of the mineral resources of Ontario."

"That this Convention is of opinion that the price of mining lands in unsurveyed districts is sufficiently high.

"Whereas an idea has been discussed in the public press relating to an export duty on nickel ores; and whereas it is cheaper to smelt the ores to the state of matte, while the extraction of nickel from the associated metals taxes the resources of the oldest centres of metallurgy; as such a duty would be greatly to the prejudice of the public interest, and contrary to economic principles, this Convention does not hesitate to record its opinion that no such proposition should be seriously entertained.

"That the Convention requests the Government to appoint suitable persons as magistrates to administer oaths for the purpose of the Mining Act in convenient places in the mining districts.

"That the thanks of this Convention are due and are hereby tendered to the Canadian Institute for having invited the members of the Convention to assemble in Toronto and meet in the Institute to discuss the questions that have been passed on during the past two days in the interests of mining, and this Convention believes that the action of the Canadian Institute in this matter and the adoption of the resolutions that have been passed will be found to greatly advance the interests of the mining community in all parts of the Province; and it is further resolved that a copy of the resolution be transmitted by the secretary of the Convention to the secretary of the Canadian Institute."

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A Phenomenal Diamond.—One of the strangest lapidarian freaks within the knowledge of diamond experts is on view at Kimberley, South Africa. The stone is in shape and size like a pigeon's egg, of a dark brown color externally, and at first sight opaque. If viewed in a dark place, with a candle or other light so placed that the rays pass through the stone before falling on the retina, however, one sees distinctly the image of a man from the waist upward. Turning the pebble, he sees at another point a woman's face, partly concealed by heavy tresses, and yet, again, on another portion of the surface being applied to the eye, a moonlit cloud sketch is clearly delineated.—*Jewellers' Weekly.*

West Indian Phosphates.

Careful planimeter measurements of the phosphate areas, based upon instrumental field work, show the Island of Navassa to have originally contained about 244 acres of gray phosphate, confined to the lower flat, while of the upper flat red phosphate there were originally nearly 300 acres.

Of the gray phosphate area, perhaps one-half has been exhausted during the last thirty years of development, yielding about 2,000 tons per acre; 95 acres have been partially worked over, and should still yield about 400 tons an acre, while 32 acres is virgin territory, from which the yield may be estimated at 1,500 tons an acre.

The red phosphate areas have scarcely been drawn from at all. An estimated area of about 40 acres already worked out is said to have furnished about 45,000 tons, and from this and correlative testimony, these upper fields may be expected to yield an average of 1,000 to 1,200 tons per acre.

The principal deposits on the upper part of the island have been divided into seven large districts or "fields;" but the surveys demonstrated the existence of at least fifty-six additional separate areas, varying from a few square feet up to 165,000 square feet (or four acres), in area, the aggregate of whose yield in tons will be considerable.

The present methods of digging, transporting and shipping the phosphate material are extremely crude and expensive, and have no doubt been largely the result of plans originally adopted when the material dug occurred close to the present wharf. The company, however, contemplate a radical change in the manner of transporting the phosphate from the diggings to the wharf and vessels, though it is extremely doubtful whether the conditions under which the material exists will justify any change in the system of mining. From the wharf a narrow gauge railroad track, about 1¾ miles in length, extends along the lower flat to the present diggings, being advanced as the phosphate is exhausted. Cars 12 feet long and 4 feet wide outside, and 9′ 1½″ x 3′ 9″ x 1′ 5″ inside, holding about 50 cubic feet of phosphate, are shoved by hand from the diggings to the wharf, where the material is stored in covered houses.

The phosphate rock is readily extracted from a series of contiguous pockets, though at a considerable discomfort sometimes to the laborer, who frequently has an opening only large enough to squeeze his body into, affording scarcely room enough to scrape or dig out the material. Occasionally, when the phosphate is hard, striking bars from a foot to fifteen inches long are used to cut it loose from the surrounding limestone wall, while often it is necessary to resort to dynamite to effect the same purpose. When the phosphate is loose and earthy, which is the character of nearly 85 per cent. of the deposit, short iron scrapers or scoops are used, when the material is thrown into a cylindrical can and drawn to the surface; here it is filled into a box tray holding about half a ton, and placed conveniently to four or five holes, thence it is wheeled to the drying pile beside the railroad track. In rare cases the phosphate holes become large enough to admit several men at one time, when pick and shovel can be brought into service, and the yield per man greatly increased, and this would seem to be more frequently the case on the upper (red phosphate) flat.

In partially dug fields it has been found possible to average about two-thirds of a ton per day per man, mostly rock phosphate; but in a new, untouched area the yield is about 1½ tons per man. From the storage house the material is thrown into hoppers on the wharf 47 feet above sea level, and from there it is drawn through long sheet iron chutes into lighters, carrying about 3½ to 4 tons, and thence conveyed to the ship.

The work so far done in the upper flat is carried on in very much the same manner, the material being conveyed in cars to the edge of the cliff and dumped there through a chute 194 feet long to cars on the lower track, and thence to the storage house. The two varieties of phosphate are stored in different compartments near the wharf, and drawn from at will. Each lighter, of which there are at present seven, is manned by five men, and during good weather is capable of making two round trips an hour to a vessel moored from a quarter to half a mile from the shore. As the average load carried cannot be over 4 tons, the loading capacity under the most favorable circumstances of wind and weather would be about 75 tons a day of 10 hours for each lighter in service. The sea current is generally so strong, and the swell so great, that this output is rarely maintained for two consecutive days, and the material when dry is constantly exposed to loss in its frequent handling, blowing away in clouds of dust. Still with all the disadvantages under which the company labors, compelled as it is to transport men, food and materials of all kinds from the United States, and greatly handicapped by the lack of sufficient appliances for landing and utilizing the same, a considerable annual output is regularly maintained, and if the plans now in contemplation, looking toward a more rapid and economical movement of material from the pits to the vessels, are carried into effect, the output can be readily trebled and the cost very materially decreased.

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Welsh Coal for Germany.—The North German Lloyd Steam Navigation Company are reported to have ordered 70,000 tons of coal from Cardiff, and the Hamburg-American Packet Line are also getting a large quantity of fuel from the same place. The leading German steamship companies, it is said, are resolved to buy English and American coals until the German coal ring is broken up.

MINING NOTES.

[From our Correspondents.]

Nova Scotia.

Whiteburn.

This district has been dull, only one mine, the Queen, having worked in March. There are reports of coming activity this summer, and of fresh capital being invested.

Lake Catcha.

Work at the Oxford mine goes on uninterruptedly, and several new and very promising lodes are reported. The development work on the old lode is proceeding rapidly, and the Rand drill plant is pronounced a decided success.

Mr. John H. Anderson has begun the erection of a ten stamp-mill to stamp his own quartz and that of tributers.

Mooseland.

The Mooseland G. M. Co. are erecting a steam hoisting and pumping gear, made by W. W. Howell & Co. of Halifax, and will develop the property purchased from Mr. Stemshorn and others. Prospects are reported as bright.

Darrs Hill District.

The new twenty stamp mill of the Dufferin Co., which was put in commission the latter part of February, ran twenty-four shifts in March, and gave great satisfaction. The iron work of the mill was supplied entirely by the Truro Foundry and Machine Co., and the mortars are of their "Homestake" pattern. The managing director of the company, Mr. A. K. Archibald, expresses himself as fully satisfied with the performance of the mill, and states that the mortars save a much higher percentage of gold than the old pattern; in fact in one run less than 7 per cent. of the total cleanings came from the plates.

Beaver Dam.

The ten stamp mill which was completed and started up in December has been running regularly, and Mr. Turnbull reports excellent results. This mill is also from the Truro Foundry Co., and in three months use shows no signs of defective material or construction. The grade of the ore obtained in March is reported considerably above the average.

Gay's River.

The fifty stamp mill of the Coldstream Mining Co. was completed last month and turned over by the contractors. Ten stamps were started and some test lots, amounting in all to over 100 tons, have been run through. It is reported that some additions will be made to the mill in the way of rock breakers and accessories. Considerable crushing stuff is stacked ready for the mill, but the mine has not yet been opened to the capacity of the mill.

Renfrew District.

There is little or nothing doing here, some five or six men only being employed. Rumor has it that more extensive operations will begin this month.

Malaga Barrens.

The Parker-Douglas Molega Mining Co., and the Boston Gold Mining Co., are all working quietly and there is nothing new of especial interest in this district. It is reported that the Molega Co. will open up the north lode again this summer; only the Rabbit lode has been worked for some months past.

Pictou County.

Some large feeders of water have lately interfered with long-wall work in lower lift of the "Six foot" seam at the Vale. A larger pump has been put in.

The principal operations at the Foord Pit being mainly in the nature of masonry linings for shaft, and other work incidental to the re-opening of the old workings, the output of coal is naturally small, being in the neighborhood of 50 tons per week.

Work at the Black Diamond goes along steadily.

The engine house and new hoisting plant at the Acadia has been completed and is giving satisfaction. The new plant is reported to be highly creditable to the management.

The Jenckes Machine Co. at Sherbrooke, Que., has just completed a very large colliery winding engine, sixty tons in weight, ordered by the Intercolonial Mining Co., for work at their Drummond colliery, Westmill, Nova Scotia. The engine is a double one with cylinders 28x60 inches, fitted with Cornish valve gear, and is 500 horse power. The drums are ten feet in diameter, and will wind over 5,000 feet of rope each, and it is intended to hoist seventeen boxes of coal at each lift from the slope of the mines, which are at present close upon 4,000 feet in depth.

The New Glasgow Iron, Coal, and Railway Company (Limited), says the *Enterprise*, New Glasgow, has issued $500,000 of 8% first preference shares, and we are glad to know that four-fifths of the issue is already taken up. The whole issue of the ordinary shares ($500,000) is held by the founders. In view of the amount of preferred shares already taken up the directors have felt themselves warranted in contracting for the furnace plant. They will also now arrange for the immediate construction of the railway and the further equipment of the iron mines, and we are assured that the first furnace will be producing iron before the end of the present year. Only one furnace will be built this year, but it is the intention of the company to begin a second furnace as soon as the first is in operation. These two furnaces will embody the very best proven modern ideas for the cheap and rapid production of pig iron, and will suffice to produce an amount of pig equal to all now imported. This company holds large areas of iron ores of fine quality. They also hold two very large deposits of limestones, both the lime and ore being tapped by their own railway, the total length of which is only about twelve miles. They also have two fine coal seams in the Marsh district, and not more than ten miles from their furnace site. In short, they are extremely well situated as regards raw material, and we confidently expect that they will, within a short time, displace the bulk of the imported pig. It certainly looks as if, unless the consumption of pig iron in Canada is increased very largely, that this company will be able to meet the entire Canadian demand for some time. The directors are: John F. Stairs, president, M.P., Halifax; Graham Fraser, vice-president, (president of the Nova Scotia Steel and Forge Co.), New Glasgow; William Jacks, Glasgow, Scotland; Frank Ross, Quebec; George F. McKay, New Glasgow; J. Walter Allison, Halifax; Harvey Graham, New Glasgow.

Satisfactory progress has of late been made floating the stock of the New Glasgow Iron and Railway Co. Of the $500,000 preferential stock all has been subscribed with the exception of $60,000, and this, it is thought, will be taken up in a day or two.

It is reported that the New Glasgow Iron and Coal Company is proceeding with the erection of a blast furnace, 60' in height, 14' diameter of bosh.

Mr. E. Gilpin, jr., secretary of the Board of Examiners of Colliery Officials, announces an examination of candidates for certificates of competency as Underground Managers or Overmen, to be held at Sydney, Springhill and Stellarton, on the 27th May.

E. Sjostedt is mining a good deposit of iron ore on East River, Pictou Co., and shipping it to Londonderry. He is organizing a company partly Canadian and partly American, and the proprietors of the Katahdin Iron Works, Maine, of which Mr. Sjostedt was formerly manager, contemplate removing the whole of their smelting plant from Maine to Pictou County, as they are also interested in the property. It is proposed to build a furnace for charcoal pig with a production of some 40 tons per day. A car-wheel factory is also being considered.

Cumberland County.

At Parrsboro', twenty miles west of Springhill, a four foot seam has been opened and a company formed to operate it during the coming summer.

At the Springhill colliery, work is now as brisk as ever, and the output is rapidly coming up to the well known standard.

Very little mining is going on at the Joggins, the work having been temporarily suspended in order to carry out some improved facilities in carrying coal from pit's mouth to wharf. Formerly the coal was sent down a shoot nearly two hundred feet, which had a tendency to crush and damage the coal. This is to be obviated by the construction of a tram line 1½ miles, operated by endless cable, which will carry the coal direct from the pit to the vessel at wharf.

Mr. R. G. Leckie, general manager of the Londonderry Iron Works, was in Ottawa the other day, and kindly furnished our representative with the following details regarding the improvements recently made in the company's plant: A new blast furnace has been built and was blown in on the 6th inst. Its dimensions are: height of stack, 75'; diameter of bosh, 18'; width of hearth, 9'; and it is constructed on the most approved plans. There are three hot blast stoves upon the Siemens-Cowper principle, 60' in height and 20' in diameter. Two blowing engines, made by Daniel Adamson and Co., Manchester, Eng., have been put in. The cylinders have a diameter of 48" and a 5' stroke. The weekly product will be between 600 and 700 tons pig iron. Two gas kilns for roasting ore, capable of treating 160 tons daily, have also been erected, with gas producers in connection. In the rolling mill, two new puddling furnaces have been added, which brings the daily capacity up to between 35 and 40 tons of puddled bar.

There have been very important developments of ore at the East mine. A large body of spathic ore has been opened at Slack's Brook, having a width of over 30 feet. About three-quarters of a mile further east the same vein is being worked in an open quarry; there it is 50 feet wide. The ore, which is free from sulphur and phosphorus, after calcination in the gas kilns averages about 42 to 45 per cent.

There are about 900 men now in the company's employ in the works and mines. The output of ore from the mines last year was about 50,000 tons; and the total production of pig iron was 18,000 tons.

A mine has also been opened up in Torbrooke, Annapolis Co., where a six foot vein of clean ore has been located and opened upon at different places over fully two miles. The ore averages 60 per cent. iron, and the earthy constituents render it very easily smelted. As a mixture for the Londonderry ores it is highly beneficial, producing the best foundry pig iron yet made in Canada, and considered equal to "Coltness" and other highest brands of Scotch pig iron. About 80 tons per day are mined from this property; 40 men are employed.

Cape Breton.

The sales of Cape Breton coals, in contracts, so far reported are: International, 90,000 tons; General Mining Association, 60,000 tons; Caledonia, 55,000 tons; Reserve, 60,000 tons; Gowrie, 45,000 tons, making an increase in contracts this year, over last year, to date of about 100,000 tons. Shipping has been almost continuous through the winter from Cow Bay. Coal is being briskly banked from all the mines, and the preparations for reopening and working the Emery, Gardiner and Ontario collieries are about complete. It is said that there will be a general demand for an increase in the prices for cutting coal in Cape Breton collieries as soon as navigation opens.

The Gowrie Coal Mining Co., Messrs. Archibald & Co., has purchased a large steamer for the coal and general trade between Cape Breton and Newfoundland.

Colchester County.

"In the East Brook," writes Mr. Hugh Fletcher, "which flows into Stewiacke River from the south, about eight miles above the station, a seam of coal, apparently not exceeding eighteen inches in thickness of mixed coal and carbonaceous shale, was lately opened. A boring sunk about 80 feet at Johnston Brook, not far distant, is said to have cut black gypsum, and the coal is probably about the same horizon as that of Kennetcook. The celebrated scythestone of Birch Hill, a fine gray sandstone, with sharp grains of silica, is found in the same neighborhood. Coal was also reported to occur at Selma, but the report seems to have arisen from the presence of thin bands of dark grey shale, marked with fossil plants, among thick beds of grey flinty sandstone, which forms barrens in the neighborhood. At the request of Mr. Robert H. Fraser, Superintendent of the Nova Scotia Central railway, a visit was paid on the 20th of October to borings made in search of coal at Spa Springs, Annapolis county. One hole had been sunk 100 feet, but nowhere in the neighborhood were rocks seen in which coal could reasonably be expected to occur."

Quebec.

Ottawa County.

There is much activity in phosphate mining in the Templeton district, and the aggregate output promises to be the largest since mining was begun. Twelve companies and individual operators are at work.

McRae & Co. have 25 men on surface work. A fine show, reported to be 20 feet wide and 50 feet long has lately been uncovered. It is intended to add an electric percussion drill to the plant already in place.

Messrs. Lomer, Rohr & Co., have opened a pit on lot 8, about eight acres from the Blackburn pit. A steam plant is being put in.

About 115 men are at work at the Blackburn. An output of 20 tons, high test, per diem, is reported.

The Macgregor Lake Phosphate Co. has started work on the Pearson property. An efficient steam plant is being put in here.

C. B. Falardeau has a force of 20 men on the old Canada Industrial property.

The Netherlands Company have 40 men on the lots purchased recently from the Templeton and Blanche River Co.

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H. H. FULLER & CO.,
Halifax, N.S.

McLaurin & Sons have 25 men on N½ lot 9 in the 12th Range.

Messrs. Fissiault and Lepage have purchased the Grandmaison property, 300 acres in extent. Price reported to be $6,000. Property undeveloped. They have also 22 men working on their property on 4th Range.

Two men were killed about three weeks ago by a fall of rock at the Perkin's property, operated by Messrs. Lomer Rohr & Co. Coroner's jury gave a verdict of accidental death.

Mr. Thos. Fee has taken out about 80 tons from the old Jackson Rae mine.

Navigation on the Lievres has been resumed.

The Dominion Phosphate Co. have, in addition to their operations at the North Star, started a gang on their Washington property adjoining the Emerald.

Much interest is being taken in the suit of the Emerald Mining Co. *v.* the Anglo-Continental Guano Co., now before the Aylmer assizes. The plaintiffs claim heavy damages for alleged encroachments on their property.

Eastern Townships.

The early opening of spring causes the asbestos miners in the Thetford and Black Lake region to hope once more. The past winter has been a hard one. A great deal of snow has been handled at the mines. Notwithstanding all, the output at most of the mines has been kept up better than other winters. There is now available an abundance of water, for which all are grateful.

Some mines, as noted in previous issues, were compelled to close down nearly all of their machinery during two months, are now working with all force.

Much new machinery is being added to the plants. Messrs. King Bros. have their crushing plant in operation at Thetford mines, and it is giving satisfaction.

The principle difficulty encountered so far in connection with the dressing of asbestos by machinery, is in separating or grading the fibre after it has been passed through the crusher and rolls. Little has been done in this direction yet other than with screens, but we think with the plants of Messrs. King and the Scottish Co., and the American Co., a great deal of the hand labor employed before will be done away with.

The property of the Scottish Canadian Asbestos Co. in liquidation, was sold April 19th, by tender. The property was bought by Col. R. E. Aitken, Glasgow, representing a new company called the Glasgow and Montreal Asbestos Co., by which name the mines will be known in future. Work has been commenced, and in a few weeks a large force of men will be employed. Mr. Matthew Penhale continues with the company as superintendent.

The Beaver Asbestos Co. at Thetford, have given an order for more machinery to be put in position at once. They will also erect a cable derrick in place of the ordinary boom.

A boiler and steam drill has been added to Messrs. King Bros. plant at their Black Lake mine.

All the mines are increasing their forces as the season advances. There is every indication of a good year's work, with a much longer output than last year.

A dividend of 20% has been declared by the Anglo-Canadian Phosphate Co. This must be very gratifying to Messrs. Irwin & Hopper, the Canadian management.

Pontiac County.

The engine house at the Bristol Iron Mines was destroyed by fire about three weeks ago. It has, however, been rebuilt and the machinery repaired.

Temiscamingue.

Work at the galena mine here has been temporarily suspended, water having been struck in the workings. Suitable pumping gear will be installed and operations resumed in a day or two.

Ontario.

The development on the Belmont Bessemer Ore Co's. property has so far been very satisfactory. No. 1 diamond drill hole has been put down 100 feet, and shows at least 60 to 70 feet of good ore—perhaps 75 feet. The cores seen show no sulphur, which had been feared; at 90 feet fine pure ore is shown with a little lime, which will help to flux it. The showing so far is fully equal if not superior in quality to some of the best Port Henry mines, and the quality is first-class Bessemer. The New York owners are much pleased, and intend to put on a large force of men at once.

The following notes of Mr. H. P. Brummell, who spent some time last year in the oil fields making investigation for the Government, will be of interest: "In Essex county extensive drilling operations were in progress at various points, more especially in the district between Essex Centre, Harrow and Leamington. At Essex Centre the Central Gas and Oil Company of that place have finished a well 1,200 feet in depth without, however, any economic result, as neither gas nor oil were obtained. At Walker's Marsh, the Messrs. Walker and Sons, of Windsor, have finished three wells from which a very considerable flow of oil was obtained. They have also been actively carrying on operations in other parts of the county, and in the adjoining county of Kent. The Citizens Gas, Oil and Piping Company, of Kingsville, during the year drilled on the road allowance, west of the well known as 'Coste No. 1,' where a daily flow of gas amounting to over 7,000,000 cubic feet per day was obtained; this gas is now being utilized in lighting the streets of Kingsville, to which town it has been piped. The drilling of this well was the cause of considerable litigation between the owners and the Ontario Natural Gas and Fuel Company, the owners of 'Coste No. 1;' the result of the suit was, however, in favor of the former company, the injunction given at the instance of the latter company not being sustained. The Ontario Natural Gas and Fuel Company have, it is understood, again undertaken operations in the county, in that part between 'The Marsh' and Essex Centre, with what result, however, we are unacquainted. Various other operators have been working throughout the county, but owing to lack of time I was not enabled to ascertain the result nor the extent of their operations.

"In Kent county, in addition to the work done by Messrs. Walker & Sons, mentioned above, a certain amount of work has been carried on, notably the well sunk by the Citizen's Gas Company of Blenheim, where in a boring 900 feet deep small flows of gas were obtained at 700 and 800 feet.

"At Stratford, Perth county, a boring was undertaken by the Stratford Natural Gas Company, which at the time of my visit, on the 12th of August, had reached 900 feet without encountering gas or oil.

"In Welland county the Provincial Natural Gas and Fuel Company, have finished their series of wells to the number of fourteen, all of which are situated in the townships of Bertie and Humberstone, in the vicinity of Sherks Station on the Grand Trunk railway. Other operators have been busy throughout the county, notably Messrs. Conmiller & White, who drilled for and obtained gas in the town of Port Colborne. John Rube struck gas a few miles west of that town; this gas is being utilized in the firing of lime-kilns owned and operated by Mr. Rube. Another lime producer, Mr. Carroll, drilled in the southwest part of Bertie township, and in the northern part of Port Colborne, Mr. Edward Wear struck a well from which a daily flow of gas of over 400,000 cubic feet is recorded.

"In Wentworth county considerable activity has been evinced in the search for gas and oil, several wells having been sunk in the vicinity of Hamilton, though with what result was not ascertained.

"Outside of the counties above mentioned, but little has been done except in the County of Lambton, where, in the oil territory of Enniskillen township, the usual amount of boring has been carried on and many new wells brought in with the usual average daily flow of oil."

Later information regarding the development work on the Belmont Bessemer Ore Co.'s property in Belmont Township, states that a diamond drill hole has been put down vertically 100 feet, fully two-thirds of which depth gave cores showing good ore with very little sulphur, but most of it carrying a little lime, which will help to flux it. At 90 ft. the core showed very fine solid ore without a trace of sulphur. This depth was considered sufficient for the first hole. They then started No. 2 hole about 300 ft. south east of No. 1, and passed through 8 ft. of very fine ore, which has analysed 68 to 70% of metallic iron, almost free from impurities. After that, however, some very hard green rock was struck, and two of the diamonds were lost and others loosened, so the bit was sent to Chicago to be reset. This rock is much the same as was met with in No. 1, and it is expected that ore will be found below it. It is intended to connect the mine with either the C.P.R. or Central Ontario Railway, and a charter is now being applied for from the Ontario Legislature, under the name of "The Ontario Northern and Belmont Railway." Recent analyses show the ore to be of remarkable purity, as will be seen:—

Pit.	Metallic iron.	Phosphorus.	Sulphur.
No. 1	63.131	.023	.004
2	69.33	.016	.0375
3	69.85	.013	.012
3	70.326	0056	.0023

The ore bed has been found to extend over 600 ft. north and south, with a width in some places of 400 ft., and other outcrops have been found about 300 yds. northeast of the present workings. It is intended to put a large force of men at work immediately.

Madoc District.

Reports from Madoc state the old Malone gold mine has been reopened. A small force is employed. Results to date satisfactory. The owners are talking of erecting a stamp mill.

There is also talk of the Delora mine starting up soon.

Some excitement has been caused by the reports of a rich discovery of gold ore at a point about 10 miles north of Malone. Particulars are not to hand yet.

Sudbury.

R. P. Travers, of Chicago, manager of the Chicago Nickel Co., has twenty men and two steam drills at work in Drury Township. Between 800 and 1,000 tons of ore have already been mined.

A Chicago company has commenced development work on D. O'Connor's property in Lorne Township. Fifteen men are at work there.

Mr. A. Merry, formerly with H. H. Vivian & Co., is opening up the valuable property sold by J. Stobie and others to the Huntington syndicate of London, Eng. The property is in Levack Township, near the Onaping River. Sixty tons of ore are now awaiting transportation to England.

Considerable interest was manifested in the Sudbury region in the recent mining convention, held in Toronto. F. L. Sperry, Judge McNaughton and W. J. Skynner, were the Sudbury delegates in attendance.

Leave the price of mining lands as they were before the 1st of last December; require a certain amount of work to be done annually on all claims taken out; open an office in Sudbury under a Bureau of Mines for the adjudication of mining claims; tar and feather the country editor who shouts "export duty," and the future of this great mining region will be assured.

The erection of the new Bessemer plant by the Canadian Copper Co. at Copper Cliff, will probably be completed in June or July.

Mr. Daws, who has been manager of the H. H. Vivian & Co. plant at the Merry Mine, for the past year, has resigned his situation and returned to England. Mr. Hendrickson succeeds Mr. Daws as manager.

Port Arthur District.

The Port Arthur Board of Trade has appointed a committee to draw up a memorial to the Ontario Government praying for the repeal of the clause in the new Mining Bill, which exacts a royalty on the product of provincial mines.

The Dominion Coal Company, of Canada, recently addressed a letter to the city council of Port Arthur, offering, for a bonus of $11,000, to build additions to its docks at Port Arthur sufficient to accommodate all the coal received by them and to handle all coal in the local trade and also all coal for shipment east and west. It is understood that the company also asks certain exemptions from taxation for the next ten years, but this point does not appear altogether clear. The company has not, thus far, done a very heavy business in Port Arthur, handling only 17,380 tons of coal last season, but the trade is a growing one and promises to be a good thing for the town.

At the Porcupine, sinking is being done from the second level and the shaft is now down about 20 feet from that point. Good ore is being encountered. Work is also being pushed in No. 3 vein where drifting is being done and here they are in good mill ore. It is expected that the mill will resume operations in about two weeks, or as soon as they can get water. A shipment was made from this mine of 40 barrels of ore a week ago Tuesday.

Apropos of the sale of the Badger and the application for letters patent by the new company, referred to elsewhere, we have been advised that Mr. H. N. Nichols is now superintending operations at the Badger and Porcupine mines. The mill is not working at present, as it is being repaired and enlarged. It will probably be ready in a short time, and will be at once put into operation. A tramway is now being built between the two mines. There are now about 65 men at work in the Badger.

British Columbia.

In our Company Column our readers will see the memorandum of association of the Westminster Slate Company, Limited. This company has been formed to purchase and carry on the Jervis Inlet Slate Quarry, now owned by H. V. Edmonds, J. A. Webster, C. E. Woods, T. F. Sinclair and H. F. Clinton. The quarry is situated near the water of Jervis Inlet, thus making the cost of transportation very light. The slate is of very good quality, of a uniform blue color, without flaws or impure matter in it, splits easily, and is said to cut much closer than the Bangor product.

The shipments from the collieries for the month ended 31st ulto., were:—

	Tons.
New Vancouver Coal Co	35,876
Wellington "	17,972
East Wellington "	3,806
Union "	4,400

"There is now in the C. P. R. freight sheds," says the *Vancouver World*, "awaiting shipment to Cariboo, a powerful piece of machinery to be used in separating the gold from the gravels of one of the mining claims in that famous gold producing country. It is none other than a hydraulic giant, from the Joshua Hendy Machine Works of San Francisco, of the largest size turned out by those famous works. In fact only one other of the same size has been made, and that for the noted Benjamin claims, in Trinity County, Cal., owned by D. V. Hays of Boston.

The machine has been purchased by the South Forks Hydraulic Mining Company, for their claim on the South Fork of the Quesnelle River. Some idea of the power of this hydraulic giant may be got from a few details of its construction. The discharge pipe is 15 feet long, on the smaller end of which a deflector is placed to control the direction in which the stream is to be thrown. With the head of water which the company will have at their command, the seven-inch nozzle will discharge about 1,800 miner's inches of water, and as 50 miner's inches is equal to one cubic foot per second, this means 36 cubic feet per second. Should circumstances demand it smaller nozzles may be used down to 5 inches in diameter. The water is brought from the tank or pressure box, 300 feet vertical height above the machine, by a pipe of steel plates 18 inches in diameter. It consequently passes through the machine into the discharge pipe under a pressure of about 130 pounds to the square inch, and comes from the nozzle with a velocity of about the same number of feet per second. The discharge pipe fits upon the machine with a ball and socket joint which gives it a deflection of almost 90 degrees in a vertical direction. The upper part of the machine, and to which the discharge pipe is attached, turns horizontally on the lower or bed part so that all these parts combining give the operators complete control of the direction of the stream. The company owns a claim which consists of a bank of gold bearing gravel with a face about 200 feet in height. Against this bank the powerful current thrown by the machine impinges, washing the earth and gravel into the sluice box four feet wide at the bottom. The gold being the heavier falls to the bottom and is caught in spaces left between the blocks with which the flume is paved. The work of such a giant apparatus is quick and effective, saving a great deal of labor, and accomplishing what would be almost impossible in any other way.

The diamond drill, working at Northfield, is going through some very hard cement filled with small black pebbles that will cut glass like a diamond, and consequently work is rather slow.

The boring machine at present in use at Comox is to be brought down to Nanaimo and started in operation at Departure Bay near South Wellington wharf.

A correspondent of the Westminster *Ledger* has had an interview with Mr. J. Bowron, Gold Commissioner for the district of Cariboo, and also with Mr. W. C. Price, foreman of the Government reduction works at Barkerville. It was learned from Mr. Bowron that a large bed of auriferous gravel had been discovered running parallel with the Quesnelle river, and extending for about ten miles, every linear foot of which has produced the value of $1. The bed, which was discovered by some Chinamen working close to the forks, lies behind the perpendicular cliffs which here border the river. It is now taken up both above and below the forks, and among the firms working on it are the following: The Victoria Hydraulic Mining company, the South Walk, Champion, Pomeroy and Whittier hydraulic mining companies. Mr. Bowron considers this one of the most important finds that has been made for many years. Both gentlemen were warm in their praises of the good work done by the reduction works, under the able superintendence of Mr. E. A. Martin, a gentleman in whom all have the most unbounded confidence, and it is their opinion that these works will do wonders towards developing the quartz mining of the district, which, on the showing of the Black Jack mine, undoubtedly has a great future before it. But on the other hand both Mr. Bowron and Mr. Price are positive that a railway going by way of the Yellow Head Pass is an absolute necessity to the thorough development of the country, both in its mining and farming districts, and also that such a line could not help proving a paying investment to its promoters.

The contractors who have the sinking of the new shaft to connect with workings of No. 1 mine of the New Vancouver Coal Co. at Protection Island Point, are making rapid progress with their work. The principal difficulty encountered as yet has been a strong spring of sulphur water which is hard on the eyes of the workmen. The shaft is being substantially timbered as the sinking proceeds. Three shifts daily are worked.

The New Vancouver Coal Co. will, during the summer, build several houses for the use of their employés. The wharf for shipment of coal will probably be commenced in the early fall, but there is no hurry for that as the shaft has to go down about five hundred feet from the surface before striking the No. 1 level.

The apparatus for lowering coal at No. 1 shaft, New Vancouver Coal Co., is giving great satisfaction and the idea will probably be extended to the other shutes in the near future. The one at present in use is capable of lowering 120 tons of coal per hour and as it is situated right over the hold of the vessel to be loaded the coal is not pulverized as when it is shot down an inclined plane for some distance.

All the shafts being sunk by the Company are going well and satisfactorily. The bore at Northfields is down 300 feet having gone through two bands of very hard conglomerate, one 80 feet in thickness and is now in another small one of the same sort.

LEGAL.

The action of White's Asbestos Company (Limited), vs. Hoare, which was heard in December last before Mr. Justice Day and resulted in a judgment for the defendant, came before the Appeal Court, consisting of the Lord Chancellor, the Master of the Rolls, and Lord Justice Fry, on appeal by the plaintiffs; but it was stated that the parties had arranged that an order should be taken by consent, dismissing the appeal with costs, and for repayment of the sum of £150, being the amount recovered by the defendant on his counter-claims, and which had been paid into Court pending the result of the appeal.

Macintosh v. Wills.

This case came up before Mr. Justice Malhiot in the Circuit Court at Aylmer, on the 15th inst. Mr. T. P. Foran appeared for the plaintiff, and Mr. C. J. Brooke for the defendant. The action arose out of the suit of The General Phosphate Corporation against Macintosh, noted in our February issue, in which the plaintiffs sued to recover certain plant alleged to have been unlawfully removed from their property. For the defence it was pleaded that said plant had not been transferred with the property, but belonged to defendant, one of the original owners, and the action was dismissed. The defendant then brought suit against the former plaintiff personally, to recover $59 damages for illegal seizure and the costs incurred. In response it was put forward that the defendant had acted in good faith as the manager of the company and believing himself to be the legal custodian of the property he had felt bound to take action to recover it. The case was taken *en delibere*. Judgment was rendered on the 20th inst., the case being dismissed.

CANADIAN COMPANIES.

De Nederlandsche Phosphaat Matschajpy.—This company has been formed for the purpose of working the phosphate properties formerly owned by the Templeton and Blanche River Phosphate and Mining Company, viz., certain areas in the 9th, 10th and 11th ranges of East Templeton, Que. Messrs. Miller & Company, Commissioners street, Montreal, are the Canadian agents for this company, of which we hope at some future date to give the financial particulars. Twenty-five men are employed.

The Westminster Slate Company (Ltd).—Application will be made for incorporation under British Columbia laws for the purpose of purchasing and carrying on the Jarvis Inlet Slate Mine, and the acquiring and working of other mineral claims, mines and stone quarries, together with other powers. Head office, New Westminster, B.C. Capital stock, $100,000 in 1,000 shares of $100 each; with power to increase to $250,000. The time of existence of the company to be fifty years. The applicants are: H. V. Edmonds, A. G. Gamble, and H. Fiennes-Clinton, all of New Westminster, B.C., who are to be the first trustees.

The Glen Iron Mining Company (Ltd).—Application will be made for the incorporation of the above company under the British Columbia "Companies Act," for the purpose of prospecting for, acquiring and working mineral claims and coal lands; the erection of the necessary plant; the operation of railway and steamship service in connection therewith, and for all other customary powers. Head office, Kamloops, B.C. Capital stock, $50,000 in 500 shares of $100. Applicants, J. W. Mackay, J. A. Mara, J. O. Grahame, H. Burchell, W. E. Scott, F. J. Fulton, all of Kamloops, B.C., and F. S. Barnard and John Irving, both of Victoria, B.C. The trustees are to be five in number. The first are: J. W. Mackay, J. A. Mara, J. O. Grahame, W. E. Scott and F. J. Fulton. The time of existence of the company is to be fifty years.

The Nelson Smelting and Mining Company (Ltd).—Application will be made for the incorporation of this company, to carry on the business of smelters and refiners, founders, assayers and dealers in bullion and metals, and products of smelting of every description; to work mines, and anything that comes within the province of a general mining and smelting business, with the customary powers thereto attached. Head office, Nelson, B.C. Capital stock, $500,000 in 50,000 shares of $10 each. Applicants, E. R. Atherton, W. A. Crane, A. J. Marks, T. C. Collins, W. Hill, C. H. Ink, G. A. Bigelow, of Nelson, B.C., all of whom are to be the first trustees.

British Columbia Roburite Explosives Company (Ltd).—This company is applying for incorporation under the British Columbia Act, in order to acquire from John Wilson, one of the applicants, for $3,000, the license to use and exercise within the Province of British Columbia a certain invention consisting of an approved explosive called "roburite," granted to the said John Wilson by an indenture dated the 29th day of May, 1889, and made between The Roburite Explosives Company, Limited, of 103 Cannon street, London, England, of the one part, and the said John Wilson, of the other part. To carry on the manufacture of the said explosive called roburite, also of powder and explosive substances and compounds of all kinds which can be manufactured or dealt in consistently with the said license; to import, purchase and otherwise acquire all compounds, matters, materials and things necessary or incidental to, or for objects aforesaid, and to sell and deal in the said explosive, powder, substances and compounds, with other powers. Head office, Victoria, B. C.; capital stock, $50,000, in 500 shares of $100 each. Applicants, J. Dunsmuir, F. G. Vernon and John Wilson, all of Victoria, B.C., all of whom are to be the first trustees.

The Phosphate Milling and Shipping Company (Ltd).—Registered by J. T. Heppell, 8 Frederick's Place, London, E.C., with a capital of £10,000, in £5 shares. Object, to acquire, in the Dominion of Canada or elsewhere, any phosphate or other mines, and to carry on generally the business of phosphate miners, etc.

Kingston Phosphate Company (Ltd).—Notice is given in the *Ontario Gazette*, that this company, incorporated under the laws of Great Britain, is by letters patent, empowered to acquire phosphate or other mines or mining claims; to carry on the business of mining, crushing and rendering merchantable such ores, manufacturing chemical manure, etc., with all customary powers and privileges.

Bras d'Or Lime Company, (Ltd).—A very satisfactory report was presented at the annual meeting of this company held in Halifax. The output of lime at Marble Mountain has been largely increased by the erection of a second patent draw kiln, bringing the total capacity for the current year up to 60,000 barrels. Other departments have also been proportionately enlarged. There is a good local demand, but the majority of the output of 44,000 barrels was shipped to New York and Boston. The financial statement was satisfactory, a good profit having been earned.

The Belleville Natural Gas and Oil Company, (Ltd).—Application will be made to the Ontario Legislature for the incorporation of this company, for the purpose of prospecting, boring and mining for gas, oil, salt or other minerals; with the customary powers respecting pipe-lines, plant, real estate, etc. Operations to be carried on in the counties of Hastings, Prince Edward and Northumberland. Head office, Belleville. Capital stock, $25,000, in 2,500 shares of $10 each. Applicants, H. Corby, M.P., T. Ritchie, J. L. Biggar, U. E. Thompson, H. Pringle, W. S. Hunter, M. E., T. S. Carman, J. E. Walmsley, S. A. Lazier, G. H. Pope, W. N. Ponton, all of Belleville, of whom the first nine are to be the first directors.

The Mattawin Iron Mining Company.—This company is applying for incorporation under Ontario laws, for the purpose of developing and operating iron and other mines in the District of Thunder Bay, and manufacturing the products of the same, with the customary powers respecting real estate, hydraulic privileges, etc. Head office, Kingston. Capital stock, $100,000 in 1,000 shares of $100 each. Applicants, B. W. Folger, M. H. Folger, F. A. Folger, M. J. Grady, Kingston, and J. Hammond, Fort William, all of whom are to be the first directors.

The Badger Silver Mining Company, of Gillies, Ontario.—This company is applying for letters patent under Ontario laws, in order to carry on the business of exploring, mining, smelting, manufacturing and refining, etc., of silver and other ores and metals; to acquire land, put up plant and machinery, etc. Operations to be carried on in the District of Thunder Bay. Head office, Port Arthur. Capital stock, $250,000, in 50,000 shares of $5. Applicants, John M. Stowell, M.E., Chas. A. Read, Walter Read, Chas. G. Sammond, and C. Preusser, all of Milwaukee, Wis.; J. M. Stowell, C. A. and W. Read and C. Preusser are to be the first directors.

The Ontario Nickel Company, (Ltd).—This company will apply to the Ontario Legislature for incorporation with power to explore for, mine, smelt and refine, nickel, lead, silver, gold, copper and other ores and metals; to acquire real estate, erect plant and machinery with other customary powers. Operations to be carried on in the District of Algoma and Toronto. Head office, Toronto. Capital stock $50,000, in 1,000 shares of $50. Applicants, J. Wright, G. S. Crawford, A. B. Cameron, W. M. Richards, G. W. S. Lindsay, W. L. McK. Lindsay, all of Toronto, of whom the first three are to be the first directors.

Newfoundland and Canadian Exploration Trust (Limited).—Registered by Burn and Berridge, 11 Old Broad Street, London, E.C., with a capital of £150,000 in £1 shares. Object, to acquire and take over the mining and other rights and property of the Newfoundland Colonization and Mining Company (Limited). The first subscribers (who are each down for one share), are: J. H. Filmer, 12 Wentworth Terrace, New Southgate; H. de J. Chudleigh, 13 Richmond Gardens, Forest Gate; P. R. Stamper, 6 Rebecca Terrace, Gomm Road, S.E.; T. Jones, 212 Boundary Road, Walthamstow; C. Ruff, Farncombe, Godalming; B. Wilkinson, 66 Torrington Square, W.C.; M. J. Burn, 11 Old Broad Street, E.C. There shall not be less than three nor more than twelve directors; the first to be appointed by the subscribers to the memorandum of association. Qualification, £250. Remuneration, £1,500, divisible. They shall also be entitled to 5 per cent. of net profits available and appropriated for reserve bonus or dividend. Such percentage shall in no year exceed £5,000, and shall be divisible.

Glasgow and Canadian Asbestos Company.—This is the name of a new company formed to take over the property at Black Lake, Que., formerly owned and operated by the Scottish Canadian Asbestos Co.

Anglo-Canadian Asbestos Company.—At the general meeting of this company held in London on the 16th instant, a dividend was declared for the past year at the rate of 20% per annum.

The Incorporated Construction Company of Canada.—Notice is given that the above company will apply for incorporation to the Dominion Parliament at its next session, with power to carry on the business of mining and manufacturing of iron and steel, of vessels, railway rolling stock, etc., with other powers.

The Montreal Coal and Elevating Company.—This company will apply to the Dominion Parliament at its next session, for incorporation, for the purpose of erecting wharves, warehouses and elevators and affording additional facilities at certain ports of the Dominion of Canada for the unloading and warehousing of coal, and for other powers.

The Hamilton Light and Power Company (Ltd).—This company is applying for letters patent under Ontario laws, with power to acquire the electric light plant, property and franchises as heretofore carried on in Hamilton, and to carry on the business of generating and supplying electricity for light, heat and power in Hamilton and within a radius of ten miles therefrom, with usual powers. Head office, Hamilton. Capital stock, $200,000, in 2,000 shares of $100 each. Applicants, W. H. Howland, H. M. Pellatt, Toronto; D. Graham, Montreal; R. Kennedy, J. M. Lottridge, R. Thompson, J. V. Teetzel, H. S. Stephen and D. R. Dewey, all of Hamilton, all of whom are to be the first directors.

The Grimsby Quarry and Transport Company (Ltd).—This company is applying for letters patent under Ontario laws, for the purpose of acquiring, leasing and selling lands for quarrying purposes in the County of Lincoln, working quarries, dressing and cutting stone, and carrying on the business in all its branches, with the usual powers. Also to carry on a general forwarding business, to build a tramway, own vessels, etc. Head office, Grimsby. Capital stock, $20,000, in 200 shares of $100 each. Applicants, S. Webster, Toronto; F. L. Webster, Grimsby; F. T. Webster, A. B. Webster, Toronto, and J. Lush, Lambton Mills, the first three to be the first directors.

The Montreal Metal Works (Ltd).—Application will be made by this company for letters patent under the Dominion "Companies Act." The powers required are: (*a.*) To deal in, manufacture and draw brass, copper and other metals, and to manufacture wires, rods and cables. (*b.*) To manufacture and deal in every description of apparatus and metals, and the appurtenances of the same used in connection with the business of telegraph, telephone, electric light, electric railway or cable companies. (*c.*) To construct or contract for the construction for others of electric light, telegraph, telephone or cable lines or plant. (*d.*) To purchase or lease electric light, telegraph, telephone or cable plants, works, lines or apparatus or any other portion thereof from other companies or corporations, or from any person or persons; or to advance money to build or operate such plant, works, lines and apparatus. (*e.*) To become a shareholder in or amalgamate with any electric light, telegraph, telephone or metal, wire, brass or cable company or corporation. (*f.*) To obtain and hold and operate and to purchase, lease or license, patents or patent rights or industrial designs, and to sell, lease or otherwise dispose of the same; with customary financial powers. Head office, Montreal. Capital stock, $50,000, in 500 shares of $100 each. Applicants, C. F. Sise, G. W. Moss, Hon. J. R. Thibaudeau, Frederick L. Béique, Q.C., advocate, John Carroll, manufacturer, all of Montreal; Charles A. Hamilton, Henry Stanley, both of Bridgeport, Conn., and Eugene F. Phillips, Providence, R.I.

Latest Stock Quotations of Canadian Companies in England.

	Price.	
Excelsior Copper, Limited, £410,738 fully-paid shares of £1	——	
Nicola, Limited, £35,000 fully-paid shares of £1	——	
Shuniah Weachu, Limited, £99,888 fully-paid shares of £1	——	
Silver Wolverine, Limited, £68,465 fully-paid shares of £1	——	
Tilt Cove Copper, Limited, £160,000 fully-paid shares of £2	——	
Ditto, £80,000 5½ per cent. debentures	——	
General Mining, Limited, £219,752 fully-paid shares of £8	3	3½
Low Point, Barrasois and Lingan, £509,100 fully-paid shares of £100	——	
New Vancouver Coal Mining and Land, Limited, £185,000 fully-paid shares of £1	¾	1
North-Western Coal and Navigation, Limited, £160,500 6 per cent. debenture coupons, June 30 and December 31; principal 1904	——	
Ditto, £149,500 fully-paid ordinary shares of £10	——	
Ditto, £900 fully-paid deferred shares of £100	——	
Sydney and Louisburg Coal and Railway, Limited, £50,000 cumulative 10 per cent. first preference shares of £10, £6 paid	7½	8½
Ditto, £14,560 fully-paid non-cumulative 6 per cent. second preference of £10	3	5
Ditto, £250,000 fully-paid ordinary shares of £10	¼	¾
Anglo-Canadian Asbestos, Limited, £11,500 fully-paid shares of £1	2⅞	3⅛
Anglo-Canadian Phosphate, Limited, £46,510 fully-paid preference shares of £10	——	
Ditto, £25,000 fully-paid deferred shares of £10	——	
Bell's Asbestos, Limited. £140,000 fully-paid shares of £5	12⅜	12⅝
Ditto, £68,400 debentures, 5 per cent.; interest January 1 and July 1	——	
Canadian Phosphate, Limited, £100,000 fully-paid shares of £1	——	
General Phosphate, Limited, 5 per cent. ordinary shares of £10, £2 paid	——	
Ditto, £5,000 fully-paid founders' shares of £10	——	
Western of Canada Oil, Limited, £200,000 fully-paid shares of £100	——	
Ditto, £99,850 fully-paid shares of £50	——	
Western of Canada Oil, Limited, £199,700 12 per cent. debentures of £100	——	
White's Asbestos, Limited, £20,000 fully-paid shares of £1	——	
Ditto, £15,000 shares of £1, with 15s. paid	——	

Excelsior Copper.—Registered September 26, 1888. Accounts to December 31 submitted in April. No dividend yet. Liquidation and reconstruction have been decided upon.

Nicola.—Accounts to December 30 submitted in November. No dividend yet.

Shuniah Weachu.—Accounts to November 20 submitted in February. No dividend yet. Shares for £12,870 held by the Company.

Silver Wolverine.—Registered October 19, 1888. No report of meeting received yet.

Tilt Cove.—In March, 1890, the properties were leased for 99 years to the Cape Copper Company, Limited, at a rent of £4,400. The Cape Copper Company advance £15,000 at 5 per cent. interest, and when this is repaid out of profits; surplus profits are to be divided equally between the Cape Copper Company and the Tilt Cove Company. The lease may be determined by the Cape Copper Company at any time on twelve months' notice. Accounts annually to March 31 submitted in November.

General Mining.—Accounts to December 31 submitted in April, but an interim meeting is held in November. Dividend for 1884, 5 per cent.; for 1885 and 1886, 3⅛ each year; for 1887, £4 13s. 9d. per cent., and for 1888 and 1889, 3¾. Reserve fund, £29,850.

Low Point.—Accounts to December 31. For 1887, 1888, and 1889, 5 per cent was paid each year on the ordinary shares publicly held; for 1888 the ordinary shares issued to the vendors got 3½ per cent., and for 1889, 2½.

New Vancouver Coal.—Reconstructed in 1889. Accounts to June 30 and December 31 submitted in November and May. For the two half-years to June, 1889, 5 per cent. per annum was paid, and for the two half-years to June, 1890, 4. Debentures, £60,000.

North-Western Coal.—The deferred shares receive no dividend until 15 per cent. per annum (cumulative) has been paid on the ordinary. Accounts to June 30. Dividend for 1887-8 and 1888-9, 5 per cent. per annum.

Sydney and Louisburg Coal.—Accounts to December 31 submitted about May. In respect of 1889 15 per cent. was paid on the first preference, leaving arrears of 50 per cent.

Anglo-Canadian Asbestos.—Reconstructed in 1889. At general meeting held on 16th April, a dividend at the rate of 20% per annum was declared.

Anglo-Canadian Phosphate.—The preference shares rank first for 7 per cent., and after a like rate has been paid on the deferred shares, both classes rank equally. Accounts to November 30, submitted in May. No dividend yet on either class. Debit to profit and loss on November 30, 1889, £4,784. One of the mines has recently been sold and another leased.

Bell's Asbestos.—Accounts to December 31 submitted in January. Dividends for 1888 and 1889, 22½ per cent. each year. Reserve, £5,000. The debentures are redeemable by 1913, by annual drawings at 115 from a sinking fund, which the directors may increase.

Canadian Phosphate.—Accounts to November 30 submitted in February. Eleven months to November 30, 1888, resulted in a profit of £2,576. which was carried forward. A dividend of 6d. per share is to be paid November 1, 1891.

White's Asbestos.—Registered April 9, 1889. Accounts submitted on December 31. Liquidation has been decided on.

Phosphate Quotations.—Messrs. Wilson & Green quote, f.o.b., Montreal: 85 per cent. guaranteed, $23.75; 80 per cent. guaranteed, $21.25; 75 per cent. guaranteed, $16.50; rising 40c. per unit per ton. 70 per cent. is worth about $13.50, 30c. per unit.

The Placing of Mining Companies on the Stock Exchange.—The following valuable suggestions in the form of a series of questions, were addressed to a Committee of the Melbourne Stock Exchange, Australia, by the Minister of Mines of the Colony:—"1. Is it desirable that before a mining company is registered or is placed upon the share market a report upon the mine be made by a certificated expert showing the facts only without inference, such expert to be appointed by, and, if necessary, responsible to the Department of Mines; no expert to be employed that has not passed an examination relative to his fitness for his position?—2. Is it advisable that companies should not be permitted to register until the percentage of capital required by law has been subscribed and a certificate produced from a bank manager that such money has been lodged in the bank? Further, that provision should be made rendering it illegal to use any money so lodged for payment to promoters or for any purpose other than mining or the management of the mine or company?—3. Is it desirable that the amount now required by law to be subscribed, namely, 5 per cent., be increased?—4. Is it desirable that persons wishing to register a company should lodge with the Registrar a declaration showing in full detail the nature of the work done with respect to the mine, its position at the date of registration, and such other particulars as are requisite to enable intending investors to form an opinion as to the *bona fides* of the promoters, and the value of the property?—5. Is it advisable to take any steps with respect to the nature of the prospectus issued by a company, and could the English Directors' Liability Act be utilised as a basis of legislation; if so, what alteration or modification is necessary?—6. Is it advisable to require companies to put aside a certain percentage of profits as a reserve fund?—7. Is it advisable to provide for the registration of brokers and jobbers?—8. Is it advisable to introduce legislation analogous to the Canadian 'Act for the Suppression of Gambling in Stock?'"

Mineral Wealth of Alaska.—A bulletin dealing with the wealth and resources of Alaska, prepared by Mr. Ivan Petroff, special agent of the eleventh census of the United States, has been issued by the Census Office. It deals with the four principal sources of wealth in this remarkable region, viz.: furs, fish, minerals and timber. The Alaskan products ranking next in value to furs and fish are gold and silver. Of other minerals only coal has thus far been prospected, and it has been discovered in various parts of the territory. The veins thus far discovered show only lignite coal, some of which is of the best quality. At the present time only one of these coal veins is operated, and this vein is situated on Herendeen Bay, on the north side of the Alaskan peninsula. The product of this mine was tested for the first time during the summer of 1890, and although the surface yield did not prove very satisfactory in steam-making qualities, there is every prospect of better coal being found as the deeper layers of the mineral are reached. This mine has the advantage of being accessible both from Behring Sea and the North Pacific Ocean, two deep bays being separated only by a narrow isthmus thirteen miles in width, over which a railway will be built in the near future. Some veins of coal near Cape Lisburne, on the Arctic coast, are utilized annually by whale ships and revenue cutters to replenish their stock of fuel, but they cannot be said to be systematically worked, Another coal mine is being developed on Kuchekmak Gulf, at the mouth of Cook inlet, but this deposit has not advanced beyond the prospecting stage, its nature being lignite, like all other veins previously mentioned. Large deposits of copper, said to be of great richness, are known to exist in the interior of Alaska, but their location is such that the difficulties of transportation are almost insurmountable. Several deposits of cinnabar are also known to exist in the Kuskokwim region, but, though located on the banks of a river navigable by light-draught steamers, mining men have thus far declined to invest money in their development.

Electricity in Mines.—The recent accidents in the Pennsylvania mines have drawn attention to the general way in which mine laws are disregarded, and emphasized the value of electricity as a lighting power. There is a certain class of men, who, disregarding all injunctions to the contrary, will go into dangerous places with a naked light, risking not only their own safety but imperilling the lives of others. This could be avoided by the use of electricity as a lighting power in mines. The Mammoth mine disaster has served to call attention to this question, and also to another one of equal moment and equal importance. That is, that the changes in the barometer, indicative of a storm, have a considerable effect upon the accumulation of gases in a mine. The barometric depression is peculiarly productive of this condition of affairs in England, and the belief exists that the same influences affect the Pennsylvania mines. If this should be the case the necessity for the use of electric lighting in mines would be of greatest value. Electricity is rapidly being accepted as an absolute necessity for clean, quick and cheap mining, and the day is undoubtedly rapidly approaching when all the motive force used in coal mining will be drawn from electricity. It is the experience of those who have placed electric plants upon their property, not only that the productive capacity of the mines has been increased, but that the character of the ore mined is of a higher order. With electric lights in mines, not only would the safety of the miners be rendered almost certain, but the property itself would be more secure, and ruinous accidents might be averted.—*Black Diamond.*

MACHINERY MECHANICS & INVENTIONS

Electric Power Transmissions in Mining Operations.

By H. C. Spaulding, Boston, Mass.

The rapid increase, during the past few years, in the number and magnitude of applications of electric power-transmission to commercial uses in this country, has been due principally to three causes: First, the ability and enterprise of those who have been identified with the progress of electrical industries, since electric illumination became an economic fact instead of a laboratory experiment; second, the readiness of the American people to adopt new and advanced methods as soon as their superiority has been fairly demonstrated; and thirdly, the economy and flexibility of the apparatus employed, when properly designed and constructed, and installed under suitable conditions.

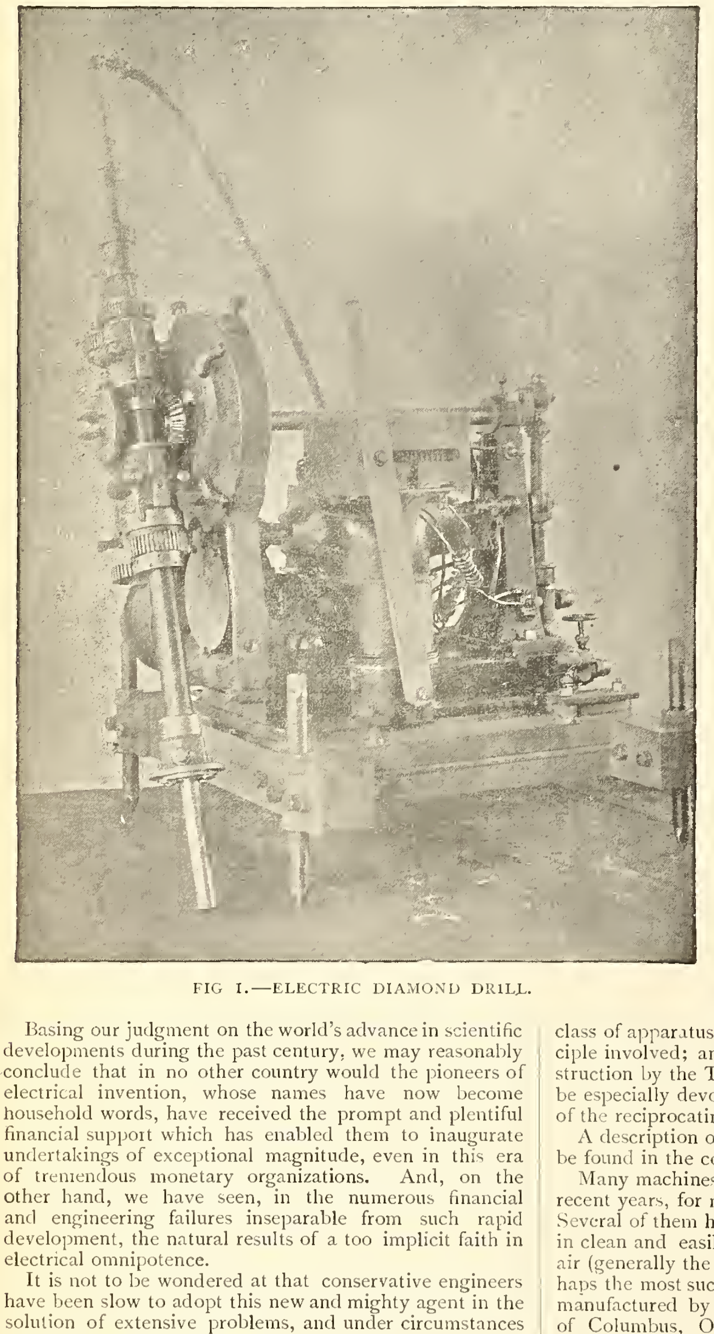

FIG I.—ELECTRIC DIAMOND DRILL.

Basing our judgment on the world's advance in scientific developments during the past century, we may reasonably conclude that in no other country would the pioneers of electrical invention, whose names have now become household words, have received the prompt and plentiful financial support which has enabled them to inaugurate undertakings of exceptional magnitude, even in this era of tremendous monetary organizations. And, on the other hand, we have seen, in the numerous financial and engineering failures inseparable from such rapid development, the natural results of a too implicit faith in electrical omnipotence.

It is not to be wondered at that conservative engineers have been slow to adopt this new and mighty agent in the solution of extensive problems, and under circumstances where a single failure means not only a greater or less financial sacrifice, but the loss, in a greater or less degree, of professional reputation.

The mechanical engineer, while recognizing the fact that thousands of horse power are to-day transmitted by electrical means, from running the lathe in a dentist's office to the operation of a fifty-ton travelling crane; from passing a cooling draught of air through a sick chamber to printing the plethoric sheets of our daily papers, hesitates, nevertheless, before placing reliance upon a system which has undeniably had its failures.

The mining engineer looks with interest upon the statement that 258[*] electric roads in the United States alone, with 1927.26 miles of track, and 3,024 cars are in daily service or under construction, and then compares the demands of street service with those found in mining practice, looking meanwhile for practical suggestions from those who have "been there" and can hold up a warning or beckoning finger to the traveller in this unfrequented path. It is the object of this paper to present briefly some of the work already done towards the application of electrical apparatus to mining processes, as well as to embody some practical suggestions and statements from those who have had personal experience in the operation of such apparatus.

Following the natural order of operations, let us consider drilling and cutting machinery in the first place. Fig. 1 shows the drill manufactured by the Diamond Prospecting Company of Chicago. This is designated by them as a Type "R" machine, nominal capacity 300 feet, and equipped with a motor of 3 horse power rated capacity. The total weight of the machine, set up and running, is 1,000 pounds, and the heaviest piece, when taken apart for shipment, weighs about 170 pounds. This machine is mounted on trucks fitting the gauge of the mine track for easy handling, and can be taken apart in fifteen minutes, and put up in a half hour without difficulty.

The drill swivels, so that holes can be put in at any angle, and can be operated in a space giving 5 feet in the line of the drill rods.

The general arrangement of electrical and mechanical parts is sufficiently evident from the illustration, though the pump is hidden by the pedestal on the right. This is operated by the horizontal shaft driven by the bevel gearing shown, and supplies a constant stream of water to the diamonds through hose connected with the top of the drill tube. In a recent test on a granite boulder, hole 1½ inches in diameter, with slow speed, this drill cut 22 inches in 40 minutes. When set up in the mine, and working on hard compact limestone, it cut the rock at the rate of 1 inch per minute, not including stoppages for changing the rods.

For general prospecting purposes this drill seems to meet satisfactorily the requirements of its special line of work.

The general principle of construction of most electro-dynamic machinery provides us with a rotary motion, which it is necessary to transform to a reciprocating in order to obtain drills of the Rand or Ingersoll type. Any such transformation, however, entails a considerable loss of power, and we are happily relieved of this necessity by recent inventions which are based on the general characteristics of the solenoid. Fig. 2 shows such a drill for general tunnelling work. Mr. C. J. Van Depoele, of Lynn, Mass, was one of the first to appreciate the demand for this class of apparatus, as well as the possibilities of the principle involved; and a large factory is under course of construction by the Thomson-Houston Company, which will be especially devoted to drilling and pumping machinery of the reciprocating type.

A description of the general features of these drills will be found in the communication of Mr. Van Depoele.

Many machines have been placed upon the market, in recent years, for making the under-cut in soft-coal mining. Several of them have met with a certain degree of success in clean and easily worked veins—steam or compressed air (generally the latter), being the operating force. Perhaps the most successful of these machines has been that manufactured by the Jeffreys Manufacturing Company, of Columbus, Ohio; and a communication from Mr. Doe, their engineer, will be found appended.

Appreciating the advantages of electric power for this class of work, Mr. Jeffreys was not slow in adopting a motor, and has used a number of those manufactured by Foree Bain, the coal-cutter being modified somewhat to utilize this power to the best advantage.

In the opinion of many practical coal miners, the principle of the rotating drill has many points of superiority in under-cutting machines, and Fig. 3 shows the result of considerable experimenting and outlay in this direction by the Hercules Mining Machine Company, of Pittsburgh. A series of drills is operated by a Tesla alternating motor, the power being transmitted by a belt as shown, and the current being supplied to the motor by three armored cables. When in operation, the cutter is clamped upon rails parallel with the face of the coal, being shifted along this track after each cut, ready for another.

Compressible springs are wound upon each drill rod, and serve as conveyers for the coal dust cut out by the drills.

A machine also embodying the boring principle, though entirely different in its mechanical and electrical design, is shown in Fig. 4.

A Thomson-Houston motor of a special type is used in this machine, current being supplied from the main-entry wires (which may also be used for lighting, haulage, and pumping), by flexible wire-covered cables.

The series of cutters (nine in number, each 4 inches wide), is so arranged as to cut close to the wall beside which the machine is placed, and within ⅛ inch of the level of the floor.

Although the weight of the apparatus complete is less than 1,400 pounds, no clamping is needed, as the drills will "pull themselves into the coal," with only the friction of the machine behind them as it rests on the floor. The device for clearing the drills of coal dust is as simple as it is effective. It consists of a series of hinged scrapers hung from the under side of reciprocating bars, one of which is placed between every pair of drills, and which also operate an ingenious device for cutting out the triangular space left by the drills at top and bottom of the cut. The present type of machine makes a cut 3 feet wide, 5 feet deep, and 4 inches thick, in two minutes and a half, including withdrawal of the drills. With these figures in mind, the claim of 180 tons capacity per day for this machine does not seem excessive. As the extreme height of the apparatus is only 23½ inches, it can be used in a vein of any thickness, and two small drums are so placed in the rear of each machine as to enable it to draw itself on to a truck which accompanies each machine, ready for moving into another chamber.

A simple but ingenious rotary drill is being constructed for operation in connection with this apparatus, deriving its power from it by a flexible shaft, and drilling the blast holes at the same time that the vein is being undercut.

Having thus briefly examined the present electrical apparatus for boring into ore or coal, so that it may be blasted out, let us see what means are at disposal for hauling it out of the mine, or from one point to another under the surface. Of course, in the majority of cases, the blast will be fired by the electric current, but a discussion of this application hardly comes within the scope of this paper.

To Mr. W. M. Schlesinger, of what was, at the period referred to, the Union Electric Company, is due the honor of constructing the first electric locomotive for strictly mining uses in the United States. This was of 35 horse power rated capacity, and was put in by the Lykens Valley Coal Company, Lykens Valley, Pa.

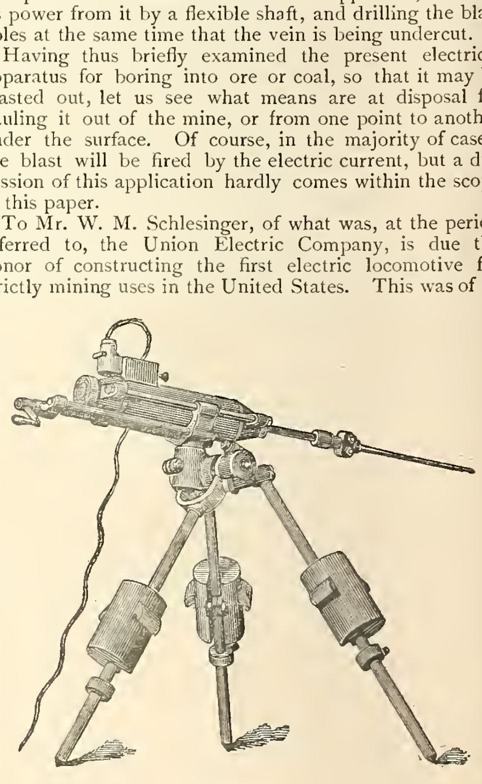

Fig. 2.

A series of iron rails were joined together to form a conductor for the current, which, after passing through the motor, completed its circuit to the generator by the track rails, which were connected also by copper wires.

A locomotive of 40 horse power capacity has been in operation at the Hillside Coal Company's Erie Colliery, near Scranton, Pa., and the installation is fully described here as showing very fairly the conditions to be fulfilled by this class of apparatus in the anthracite coal regions of Eastern Pennsylvania.

The power plant consists of a standard Armington & Sims engine capable of developing 60 horse power, and a 50 horse power Thomson-Houston generator wound for a current of 220 volts potential, and the necessary appli-

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[*] August, 1890.

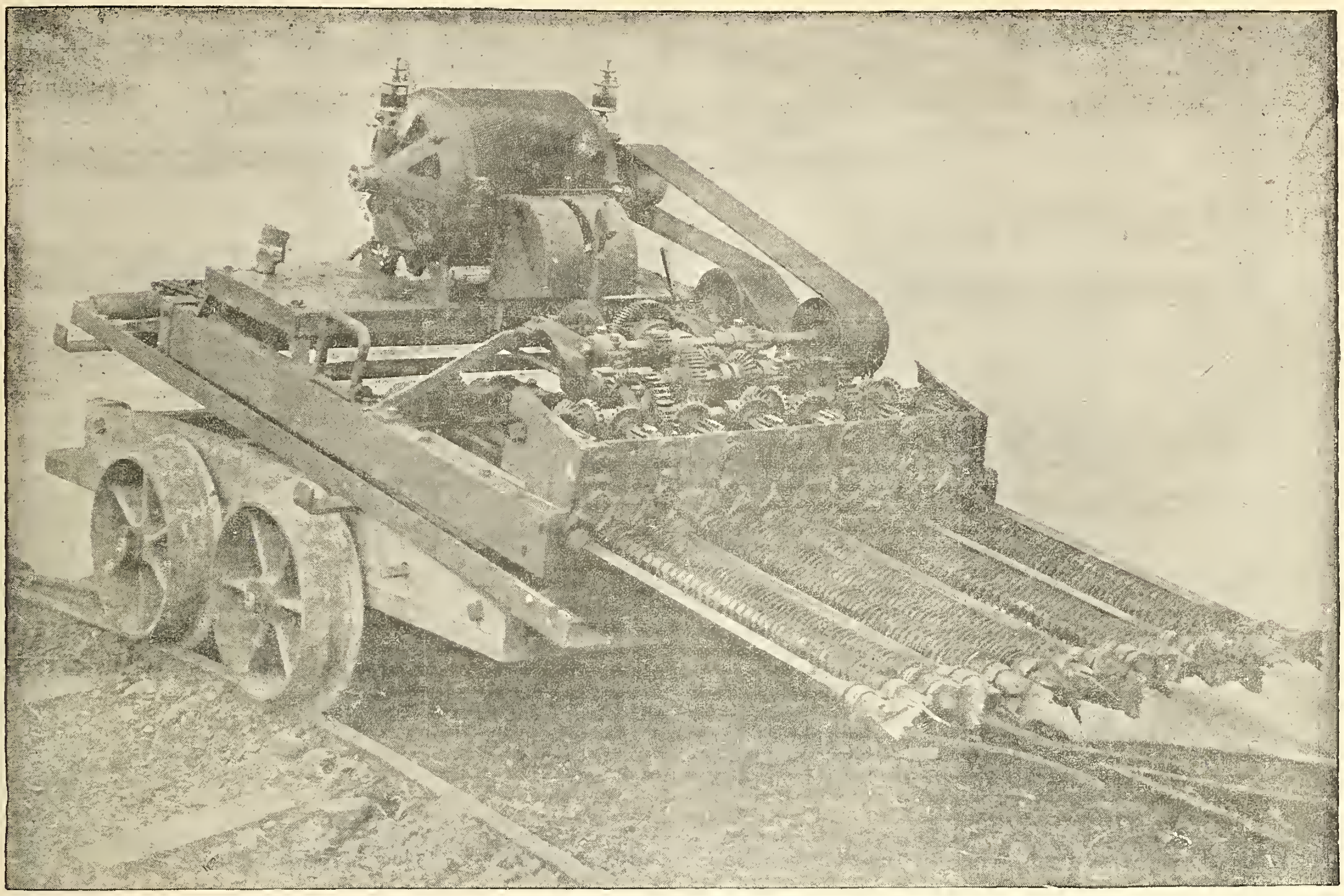

FIG. 3.—ELECTRIC COAL CUTTER OF THE HERCULES MINING MACHINE COMPANY.

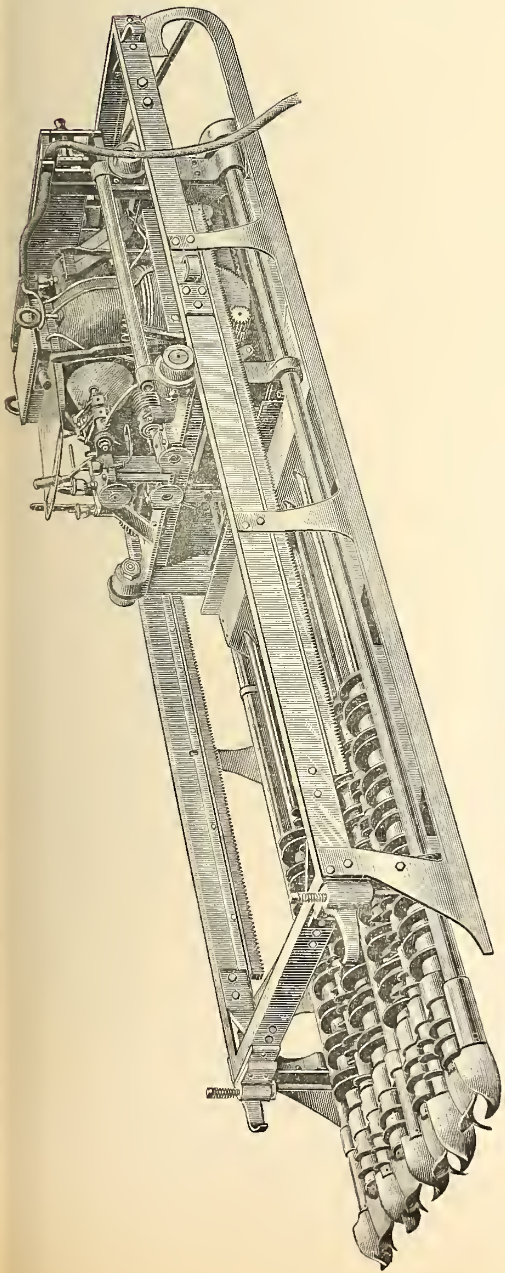

FIG. 4.—ELECTRIC COAL CUTTER.

ances for its operation. The engine and dynamo room at the top of the shaft are in charge of the engineer and assistant, who operate the other mining machinery.

From the dynamo to the foot of the shaft the current is conducted by No. 0 Clark wires, enclosed in gas pipes to protect them from damage. From the bottom of the shaft the wires are carried overhead, about 12 inches outside of the low rail of each track, and are suspended from an insulator specially designed for this class of work, the construction of which can be readily seen from the accompanying illustration (Fig. 7).

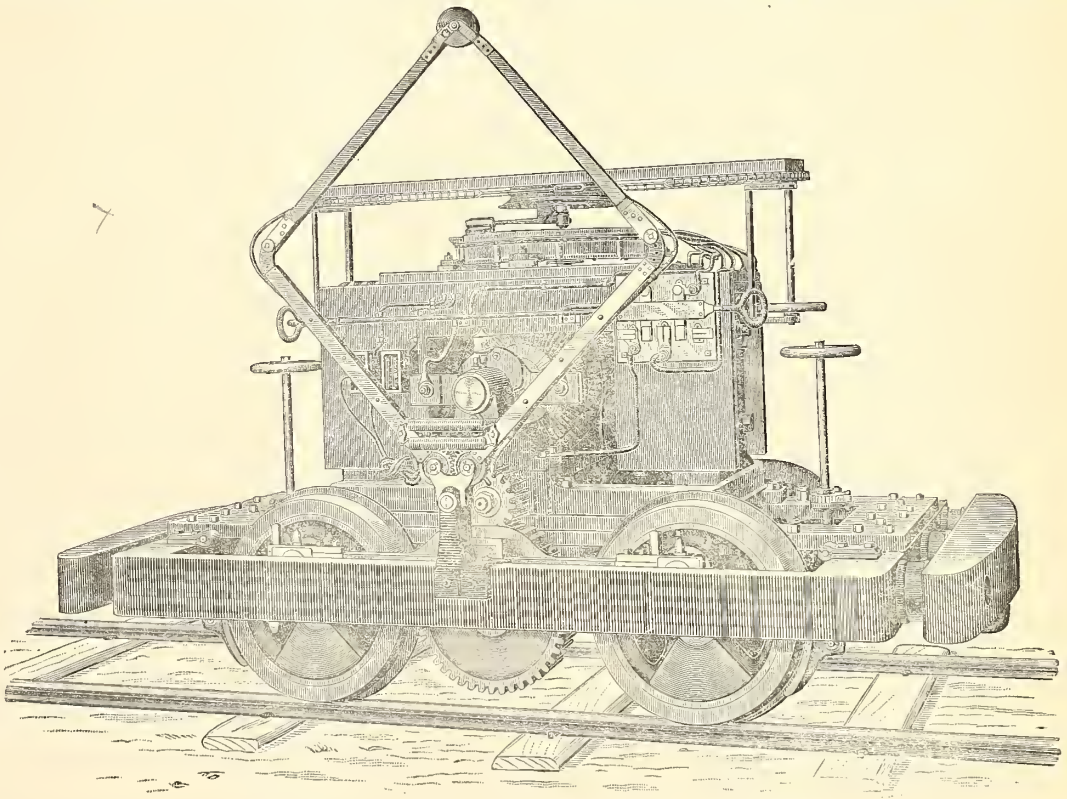

FIG. 5.—40 HORSE POWER ELECTRIC MINING LOCOMOTIVE.

Wherever turnouts occur, frogs (shown in the cut) are used, the conductors being soldered to them in the same manner as when used for street railway work. Connections from the mains to the overhead conductor are made at suitable intervals, and a portion of the current is utilized for lighting purposes, two 110 volt lamps being placed in series. There are fifty of these lamps—eight at the foot of the shaft, two in the pumping room, four in the blacksmith shop, and two in the slope room; the remainder being distributed along the gangway, as shown by the black dots in Fig. 8, Plate 1.

The rails are used as conductors for the return current, copper end connections effecting a complete metallic circuit. In adapting the tracks to the electric system it was found necessary to make a few changes to accomodate the increased output. The shaft sidings, as shown in the plan, will accomodate seventy loaded cars and fifty empties, whereas, before, they had a capacity for but fifteen on each side. The profiles and plan of the tracks will be seen from the diagram (Fig. 8). The track from X to R, or foot of the rock plane, is 36-inch gauge. The other tracks are double gauge, or three-rail tracks, the gauges being 36 and 28 inches. They are made in this manner to accomodate the slope wagons, which are all of the narrower gauge.

The locomotive shown in the illustrations (Figs. 5 and 6), embodies many new features in motor construction and general design, and, under practical test, has shown that it is particularly adapted to the work required of it. It is built for a 3-feet gauge, and is of the following dimensions: Length over all, 9 feet 7 inches; width, 5 feet 3 inches; and height, 5 feet 6 inches. This last dimension can be considerably reduced by placing the rheostat at one end instead of on the top, as has been done in the present instance. The weight of the locomotive is 10,500 pounds, to which 1,800 has been added to increase traction. The motor employed is of the type "G" railway motor of 40 horse power.

A novel trolley arm is used, which requires no attention when the motor is reversed. Its construction is such that a wide variation in the position of the conductor is permissable, a range of 3 feet 6 inches being easily covered, while the meeting of an obstruction simply causes the trolley arm to fall by the side of the car without resulting in any damage. From the trolley wheel the current passes along the arm to the fuse boxes, then through the rheostat and motor to the rail. Pinions on the armature shaft mesh with intermediate gears, connection between these and slotted connecting rods being made through the ordinary crank pin and box. This arrangement allows for variation in position between the wheels and body of the locomotive which carries the motor; and, as the crank pins on opposite sides are placed at an angle of 90 degrees, there are no dead points. The brake mechanism, rheostat and reversing switch may be operated from either end by the hand wheels shown in the cut. The operator has everything under complete control, and can start or stop the car and reverse its direction, without moving from one position.

The locomotive is run by one man, who is assisted by a boy in making up the trains and turning the switches. It displaces seven mules and three drivers. During a period of 11½ days the average number of cars delivered at the shaft bottom by the locomotive was 559.5, against 526.95 per day delivered by mule haulage, much time being consumed by waiting at the bottom of the shaft for empty cars. Thus far, the locomotive has shown that it will increase the daily output to 700 cars per day. The operations are as follows :—

East or Slope Side.

Distance run per trip, including making up, etc.,	2,884 ft.
Time of trip, - - - - - - -	10½ min.
Cars per trip, - - - - - - -	15
Trips per day, - - - - - - -	16
Miles run per day, - - - - - -	8.73
Total time, - - - - - - -	2 hr. 40 min.

Locomotive reversed 128 times per day.

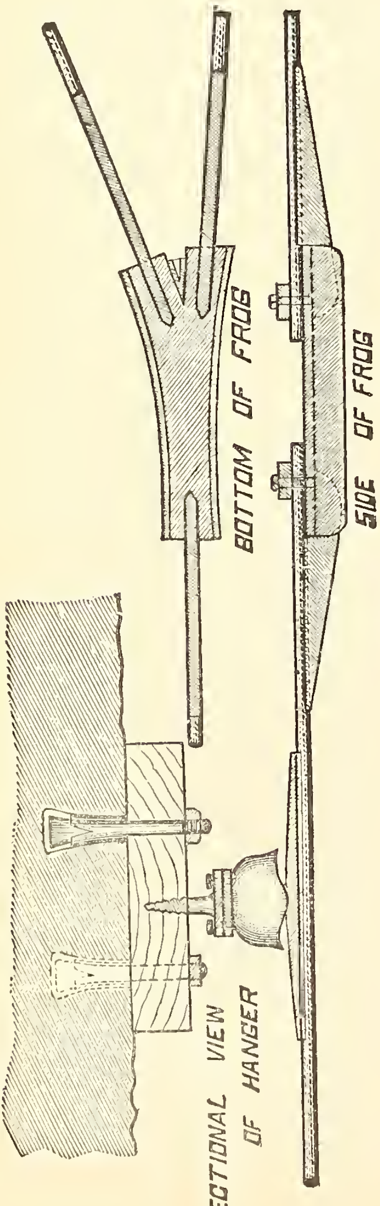

Fig. 7.

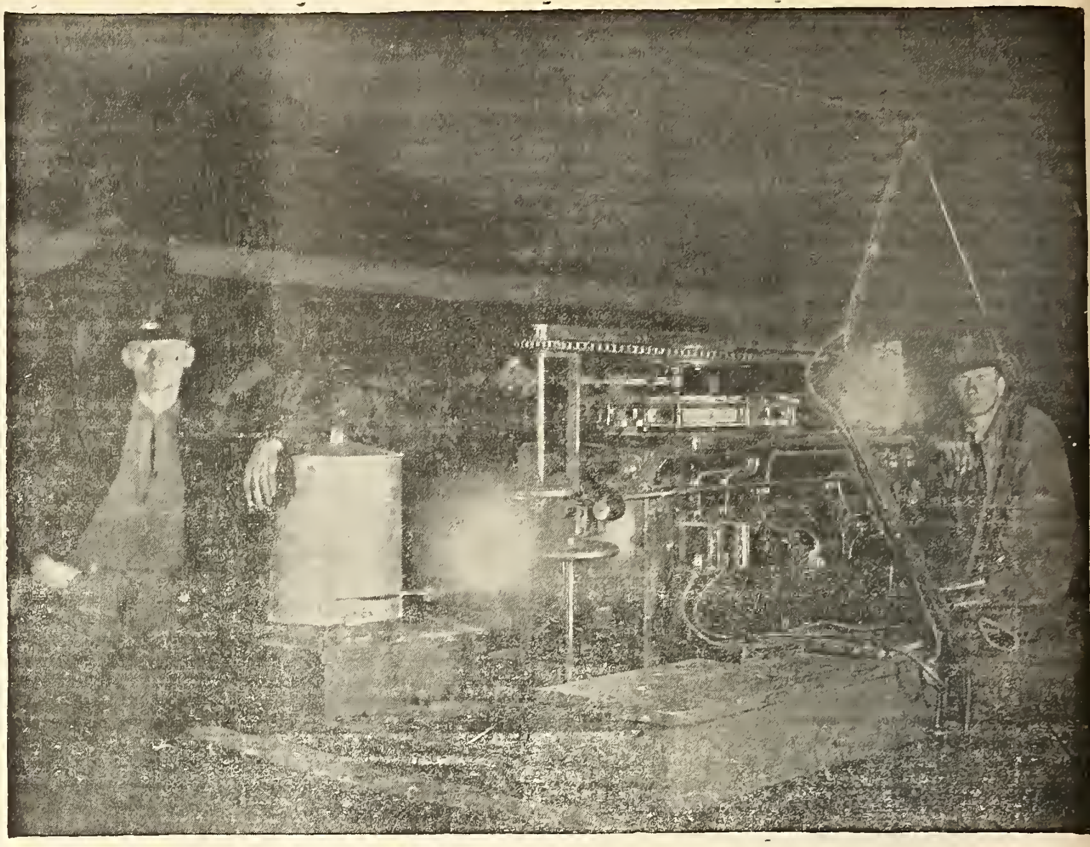

FIG. 6.—ELECTRIC MINE LOCOMOTIVE.

West or Plane Side.

Distance run per trip, including making up, etc,	2,546 ft.
Time of trip, - - - - - - -	6½ min.
Cars per trip, - - - - - - -	20
Trips per day, - - - - - - -	25
Miles run per day, - - - - - -	12.55
Total time, - - - - - - -	2 h. 50 min.

Locomotive reversed 104 times per day.

To deliver 700 cars per day of 10 hours, the time of running the locomotive is 5 hours and 30 minutes, leaving 4 hours and 30 minutes for contingencies. The total distance run is 21.28 miles, and the locomotive is reversed 232 times.

The Thomson-Houston Company has now under construction for another Pennsylvania mine, a locomotive of 60 horse power capacity, which (although of the same general type), will be so modified in design as to stand only 4 feet in the clear, above rails, the gauge being 3 feet. (Fig. 6).

The same general plan is applicable to mine tramways, of even 12 or 18 inches gauge, suitable for narrow entries, such as are found in some of the western gold and silver mines.

For hoisting purposes, we may have a variety of forms and sizes, from a 3-horse whip, for hoisting small buckets, to a machine capable of operating a full sized cage under its maximum load. Fig. 9 shows a hoist of the Webster, Camp & Lane make, equipped with a motor, for use in the Ashland iron mine, at Ironwood, Michigan, while Figs. 10 and 11 show different views of a line of electric hoists recently put upon the market for miscellaneous uses and ranging from 10 to 80 horse power.

In the Castle Gate mine, Utah, a 35 horse power Lidgerwood Thomson-Houston hoist is located about 1,000 feet inside the main entry, for handling the trains at that point.

In pumping machinery, a peculiar apathy seems to exist among prominent manufacturers as to the demands of this kind of work. There are, of course, innumerable cases where centrifugal and plunger pumps have been belted or geared to motors to accomplish certain objects; but the pump shown in Fig. 12, is the first of considerable size which, to the writer's knowledge, has been designed, with special reference to operation by electric power, and which is in itself a mechanical unit, so to speak.

This pump is manufactured by the Gould Manufacturing Company, of Seneca Falls, N.Y., and the table of tests given below, shows its efficiency when operated by a 15 horse power motor of special winding. These tests were made with a view to determining the general fitness of the type for deep mining pressures, and the results have been considered sufficiently satisfactory to warrant the designing of a standard line of pumps of from 50 to 500 gallons per minute capacity.

Tests on Gould Pump, July 31, 1890.

Pressure, lbs. Per sq. inch.	Gallons per min	100	125	150	175	200	225	250
0	Electrical H. P. Mechanical H. P. Efficiency	1.2 .12 .10	1.5 .16 .10	1.8 .18 .10	2.2 .21 .10	2.7 .23 .071	3.3 .26 .071	3.9 .26 .072
20	Electrical H. P. Mechanical H. P. Efficiency	2.91 1.38 .48	3.67 1.74 .47	4.16 2.09 .50	5.06 2.42 .48	5.87 2.83 .48	6.56 3.10 .47	
50	Electrical H. P. Mechanical H. P. Efficiency	5.16 3.11 .602	6.52 3.95 .606	7.75 4.75 .612	8.98 5.62 .615			
75	Electrical H. P. Mechanical H. P. Efficiency	7.30 4.69 .643	8.64 5.79 .670	10.48 7.06 .674				
100	Electrical H. P. Mechanical H. P. Efficiency	9.21 6.16 .670	11.54 7.77 .673	12.25 8.36 .682	Speed of Pump, 27 revolutions.			
125	Electrical H. P. Mechanical H. P. Efficiency	11.29 7.74 .686	13.88 9.37 .675					
150	Electrical H. P. Mechanical H. P. Efficiency	14.02 9.17 .654	15.16 10.19 .672	Speed of Pump, 22 revolutions.				

The Efficiency, in this Table, is the Mechanical, divided by the Electrical, Horse Power.

The pump as shown, consists of three vertical cylinders, within which are three single acting plungers, their cranks being hung from the main shaft at 120° angles, in order to produce the most even application of power. In addition to this class of pumps for general hydraulic work, the Van Depoele type of reciprocating engine is being adapted to a sinking pump which has, as yet, not been sufficiently tested to warrant further mention here.

I need hardly mention the subject of ventilating apparatus, as the application of motors to revolving fans of any kind is a mere question of belts or gears, though the fact that the fan with its motor, may be located at any desired point within the mine, with an expenditure of power hardly greater than would be necessary outside, has a marked bearing upon the general arrangement and efficiency of ventilating systems.

The question of lighting, also, though a most interesting one to the engineer and operator, hardly falls within the scope of this paper. It is sufficient to call attention to the fact that the same wires which furnish current for a part or all of the apparatus enumerated above, will make the interior of the mines as light as day, and give a beneficial result, not only directly in the amount of product, but indirectly in the satisfaction and comfort of the men. This is not theory, but has been demonstrated to the satisfaction of all concerned, and in cases were there was at the start, among the miners themselves, a hearty and bitter opposition to the new system.

Before considering the question of surface arrangements, let us pause a moment, to answer the oft-repeated question as to danger.

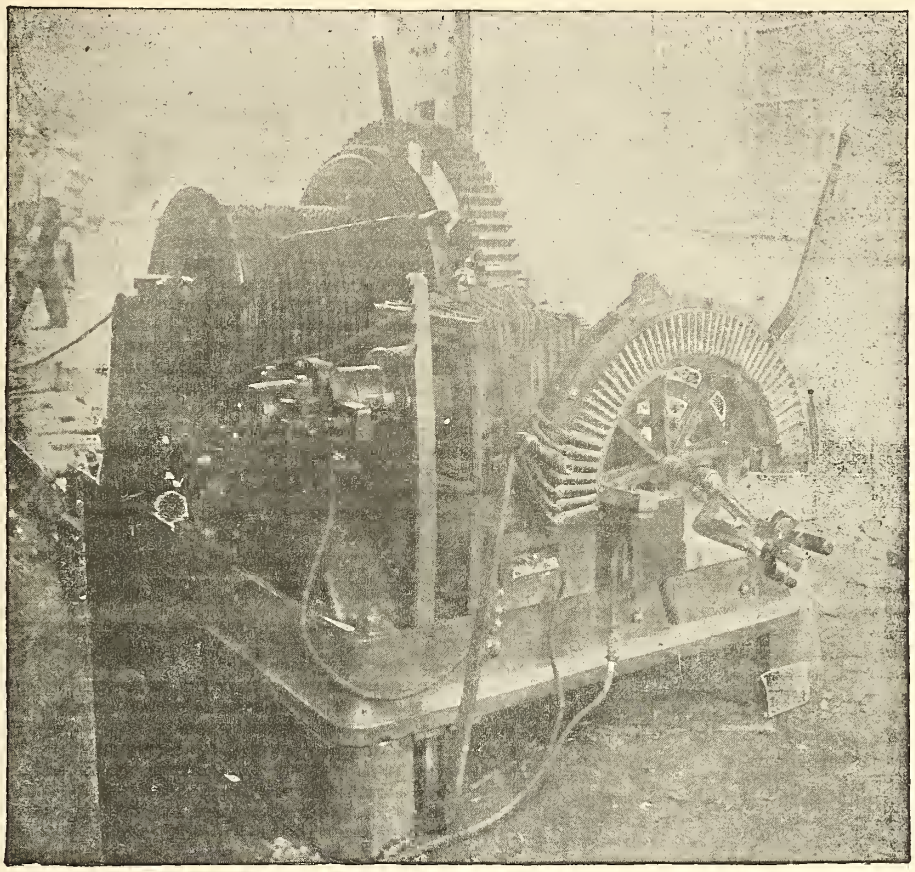
FIG. 9.—ELECTRIC HOIST OF WEBSTER, CAMP AND LANE.

The danger of accident from any class of electric machinery in mining operations is of three kinds: first, physical injury from contact with conductors or apparatus, through which a current is passing; secondly, danger of fire or explosion from a spark in some part of the electrical apparatus; and thirdly, failure of the apparatus to work properly at critical moments. Regarding the first point, it may be said that a limit of 250 volts has been fixed by many experts in mining and electrical engineering for all apparatus to be used below the surface; and that *permanent injury* from a current of this tension, *regardless of its amount*, is *absolutely impossible*, the only liability to danger lying in secondary and indirect accidents, owing to the surprise and momentary discomfort due to an accidental shock. A hot steam pipe carries more danger for the man who unexpectedly touches it than a bare copper wire carrying enough current to cut and haul two thousand tons of coal a day, at the voltage named above. As to the second source of danger, no electrical apparatus, if properly installed, should ever spark at known and properly guarded points; the amount of protection at these points being entirely dependent upon the knowledge of the designer, faithfulness of the operator, and common sense of the purchaser, in spending sufficient money on safeguards. As to the third point, no class of apparatus ever designed is free from the possibility of accidental derangement, and at critical moments. But of electrical apparatus, it may be said that no type of machinery will answer more quickly to sudden demands upon its capacity, or give a plainer indication of continued abuse; while, on the other hand, no system of power transmission is capable of more rapid repair in case of temporary derangement. We have but to compare the work of mending a broken air or steam pipe, or splicing a parted cable, with that of making a simple twist in a broken wire, and we need not wonder at the recent prophecy of a prominent naval officer, that coming warships would carry no steam outside their boiler and engine room.*

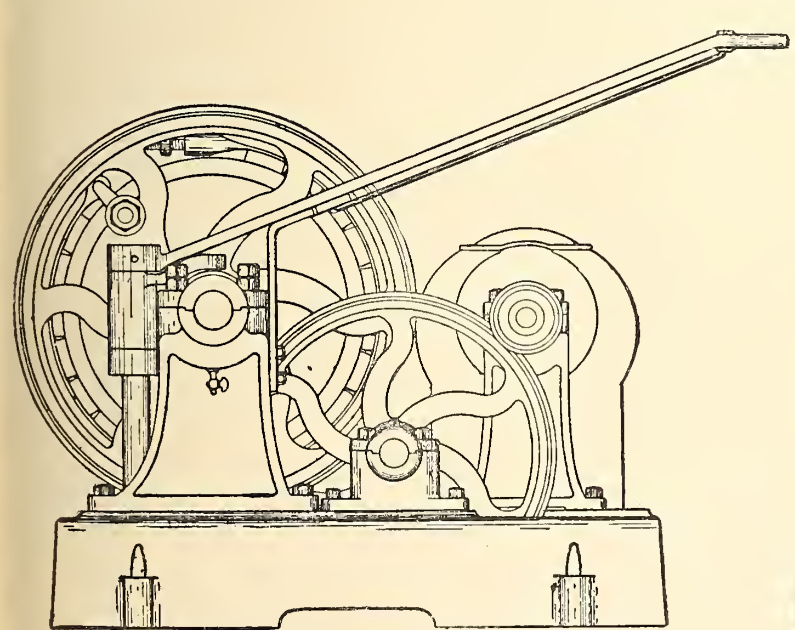
FIG. 10.—ELECTRIC HOIST, SIDE VIEW.

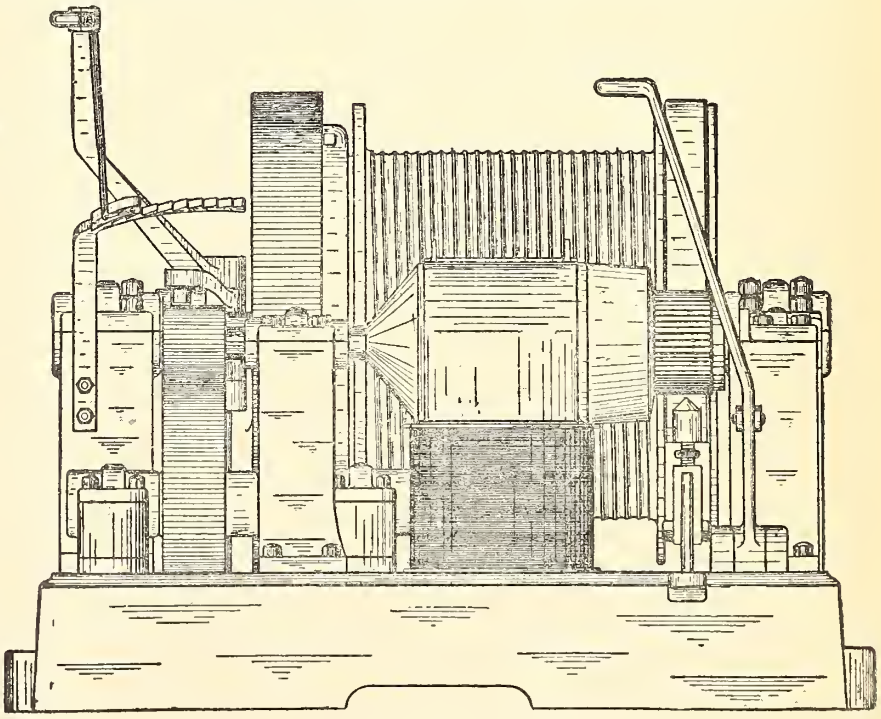
FIG. 11.—ELECTRIC HOIST, FRONT VIEW.

Let us consider now the demands of the generating system which will enable us to furnish the proper current to our apparatus to the greatest advantage.

If we have an abundant and steady water power at hand, so much the better, as the expense of maintainence then becomes practically a matter of interest on investment. If, on the other hand, we must rely on steam, let us be sure and have an ample boiler capacity to begin with. Many an electrical installation has been condemned by casual observers when the fault lay between the coal pile and the dynamo belt. It is, however, the province of this paper to consider, not the generation of mechanical energy, but its transmission; and, accordingly, attention will be given first to the current generators.

Fig. 13 shows a generator of 85 horse power capacity, suited for mining work, manufactured by the Thomson-Houston Electric Company. It is equipped with sliding base, and self-oiling bearings, and weighs 10,000 pounds.

Mounted on brick or stone foundations in a dry cool room, free from flying dust of any kind, these, with A 1 oil, and *cleanliness*, should need practically no attention except at starting and stopping.

Cheap machines will not answer for mining work. One cannot shut down for a few hours whenever it is desirable to have a new commutator put on, or a little shellac and braid here and there; and a thousand dollars more on the original investment is a good deal better than six or seven hundred a year for repairs.

Plates II, III, and IV, show respectively, the front and end elevations and floor plan of a power plant just erected by the Pleasant Valley Coal Company, at Castle Gate, Utah, which is, in many respects, a model of its kind.

It has a capacity of about 750 horse power of generating machinery, which will be used for furnishing current to electric coal cutters, drills, pumps, haulage engines, ventilating fans, etc., the entire power needed for the various mining operations being transmitted electrically. As this is the first plant of such magnitude employing electric apparatus to the exclusion of other systems, the result will be watched with interest.

I append some communications kindly furnished by gentlemen who have given special attention to various branches of the subject of this paper. To these, as well as to others who have furnished various data of interest, I wish to express my thanks.

(To be continued).

A Good Report.—The Thomson-Houston Electric Company's report for the year ended January 31, 1891, shows that the surplus account at that date was $6,022,533, against $1,685,415. The total assets were $18,905,106. Eighteen months ago the direct liabilities of the company were over $1,250,000 in excess of present liabilities, besides which the company had unmatured payments on account of contracts of about $2,500,000. These have all been met.

Wastefulness of Steam Hammers.—To obviate the notorious wastefulness of steam hammers an improvement has been introduced at the Chemnitz Works, in fitting the hammers with two pistons of different diameters, compounding them, in fact. The tup is raised by steam at boiler pressure acting on the under surface of the smaller piston; and this steam, on expanding, adds to the force of the blow by acting on the upper surface of the larger piston.

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*Some of our latest additions to the navy have more than twenty steam engines for hoists, pumps, etc., in different locations, any one of which might be rendered useless by a stray shot, not to mention the demoralizing effect of escaping steam; while the wires of electric apparatus for the same purpose may be almost instantly repaired.

Motor Car Haulage at Shawnee, Ohio.

The Jeffrey Manufacturing Company of Columbus, Ohio, installed one of their electric mining plants at the mines of the Upson Coal Co., Shawnee, Ohio, late in the fall of 1890. This plant consists of one 100 H. P. dynamo, with the necessary electrical instruments, copper wire and Jeffrey patent trolly line transmitting the current at a pressure of 220 volts into the mine, where the eleven foot vein of Shawnee coal is undercut by two of the Jeffrey Standard mining machines.

The coal, after being loaded on cars of three tons weight each, is hauled from the parting to the tipple by a five ton 20 H. P. Jeffrey electric motor car, as shown in the engraving. The Upson Coal Company report that their electric plant is giving perfect satisfaction, and has not caused them a delay of half an hour since it was started.

The Jeffrey Manufacturing Company have installed a plant of two engines and two dynamos to run from six to eight mining machines, at the Helvetia mines, in Jefferson County, Pa. They are also installing a plant at the mines of the Union Colliery Company, Vancouver Island, British Columbia. They are receiving increased orders for electric mining machines from customers who have been using them for the past year. This speaks well for their success.

By the way, we have to acknowledge the receipt of a very handsome and beautifully illustrated catalogue of coal mining machines, coal drills, motor cars, coal screens and other specialities in mining machinery, manufactured by this company. Not only is the appearance of the work fine, but a great deal of useful information is to be found within its pages, which will be found valuable to the miner in his selection of machinery.

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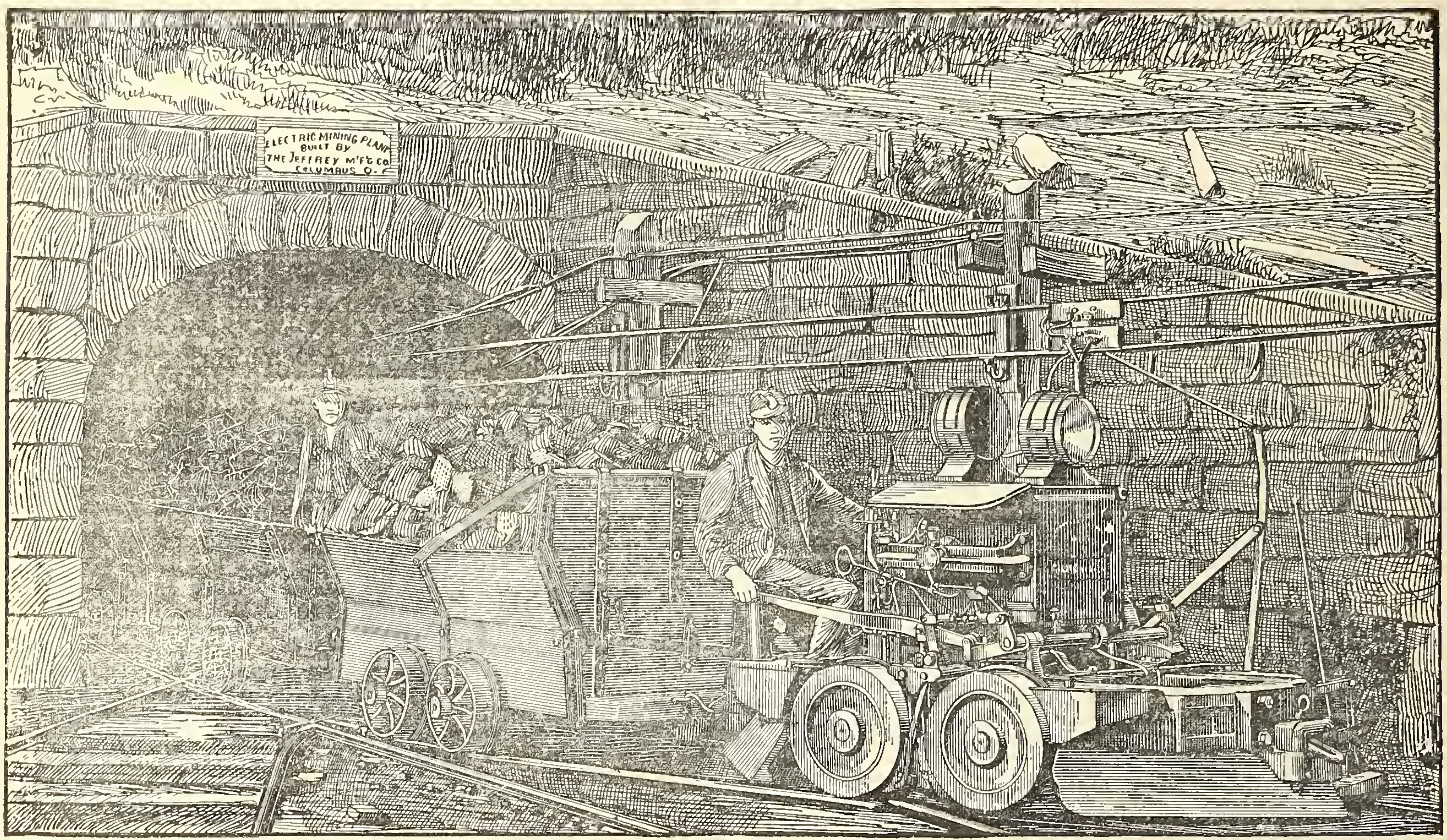

A Test of Rock Drills.

At the exhibition of Mining and Metallurgy held at the Crystal Palace, London, last summer, a trial was made of the various kinds of rock drills exhibited, with a view to testing the comparative efficiency of each class. Seven power and two hand drills were entered. All were of the striking or percussion kind, and may be classified into three general divisions: (1) Drills in which the valve is worked by air pressure; (2) drills having the valve worked through mechanical connections by tappets or cams; (3) valveless drills, in which the main piston itself performs the office of valve. In the first of these classes the piston performs the function of a valve for reversing the actual valve, while the latter, in its turn, causes the motion of the piston to be reversed. In the second class the motion of the piston is employed to reverse the valve by knocking it over the ports.

The rules governing the competition were settled by the engineer of the Exhibition and agreed to by all the competitors. The drills entered for the trial were: McCulloch's "Rio Tinto," Stephens' "Climax," Bickle's, Ingersoll-Mayne, Davis, Coles', Hathorn's "Eclipse," Ingersoll hand power, and Bromfield-Ingersoll hand power. All the drills were fed by hand, none being worked with a self-acting feed.

We excerpt the following from the judges' report: "Turning to the actual results of the work done by the rock drilling machines which were tried, it is difficult to form any broad and general conclusions as to the efficiency of the different drills, as this may be connected with variations in the principles and details of the valve mechanism employed. What really does appear is that the important points are purely of a practical nature; and the following may be profitably discussed:—mechanical details; certainty of action; weight of mechanism in relation to durability and portability.

"The mechanical details have already been described. It did not appear at the trials that there was any practical difference in the certainty of action between the valves moved by air and those worked by tappet.

"As regards weight of machine for a given size, it is of course desirable to have it as light as possibile for the sake of portability; but considering the rough usage to which a rock drill must necessarily be subjected, strength of parts is still more important. In the trials the large and therefore heavy machines were those which did the best work, namely those with 3½ inch cylinder, weighing from 280 to 308 lbs. each. The 3 inch machines, weighing from 190 to 264 lbs., did good work. There was only one 2½ inch machine tried, but its full capabilities were unfortunately not properly tested, because the air was throttled at the inlet cock. Small and therefore light machines are no doubt required, and are serviceable for certain classes of work; but for quarry work the larger machines would appear to be superior. The stability of the machines which were tried on the quarry bar, was added to by the fact that there were always four drills on the bar during the trials, while only one was at work at a time; but in the tripod trials each drill was provided with its own tripod without any additional weights whatever. In all the trials the holes were vertical, or as nearly so as practicable.

"From the particulars given of the work done by the hand power machines, it does not appear that these are equal in efficiency to the hand hammer in drilling vertical holes. The first machine with two men drilled a 1¼ inch hole 12·37 inches deep, having a capacity of 16·69 cubic inches, in 17 minutes; whilst three men by hand, two striking and one holding the chisel, drilled a somewhat larger hole 22 inches deep, having a capacity of 27·64 cubic inches, in 18½ minutes. In this comparison no allowance is made for the labour of moving and fixing the machine."

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An Electric Pumping and Hauling Plant.

An important electric plant on a large scale has been put in the Hyde Lane Pit, owned by the Dukinfield Coal and Cannel Company, England. The power is conveyed a distance of 700 yards, and the main object for which the plant has been erected is to pump water out of the dip workings to the bottom of the shaft at the rate of 10,000 gallons per hour, and the vertical height to which the water is raised is 160 yards along an incline 400 yards long, dipping 1 in 2½, and for which purpose the following machinery has been erected: On the surface in a special engine-house is fixed a pair of horizontal high-pressure steam engines, 14¼ in. cylinders, 2 ft. stroke, running ninety-six revolutions per minute, with 80 lb. of steam pressure on the boilers; these engines drive direct, by means of a 12 in. link belt, the dynamo or generator, which is one of Stanley and Davies' patent "Excelsior" type capable of giving an output of 220 volts, and 200 ampères, or 60 horse power, at its normal speed of 500 revolutions per minute. From the generator to the motor, which is fixed down the pit 700 yards distant, the current is conveyed through specially insulated stranded copper cables, having a carrying capacity of twice the maximum load. The cable is carried on porcelain insulators. The motor, which is of the same type of machine as the generator, will give out 40 effective horse power, running at 700 revolutions per minute. This machine drives direct on to the pulley or pump shaft, by a 10 in. link belt, driving same through one pair of spur wheels; the pumps make 40 strokes per minute. Special care has been taken in the design of the pumps to make all working parts easily accessible, and to avoid all internal packings; all glands are packed from the outside, and any of the valves can be examined with very little trouble. The pumps are of the horizontal type, having four single-acting rams 8 in. diameter, 8 in. stroke; two sets of pumps are mounted on each bed, and the rams are bridled together in pairs, the cranks and connecting rods working within the bridles, and the cranks are set at such an angle to each other that the working load or strain is equal in any part of the stroke—a most desirable feature where electricity is applied. The two beds are hound together by cross-girders, making the whole a strong, compact and self-contained piece of machinery. The pump house, which has been cut out of the solid rock, is brick arched, about 50 ft. long, by 15 ft. by 10 ft. high, and is lighted by four electric lamps of 16-candle power each. The water is conveyed up to the shaft through 400 yards of 6 in. wrought iron piping. The generating dynamo on the surface supplies current also for the general lighting of the colliery, both on the surface and down the pit. The offices, engine houses, workshops, screens, pit bank, and down the shaft are all lighted by incandescent lamps, varying from 16 to 50-candle power, and are fitted with the usual special colliery fittings, according to positions, and near the dynamo are found the measuring instruments and distributing board, bringing the whole conveniently under the control of the man in charge. This plant has been working very satisfactorily for about three months, but the hauling arrangements which form part of the scheme are not yet complete. These will consist of two similar motors of 20-horse power each, fixed at the top of two main hauling roads, coupled direct by gearing to the hauling apparatus.

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The Penberthy Automatic Injector.—This injector, although known in Canada but a few years, has gained a reputation unequalled by any injector that we have ever heard of, for the short time it has been on the market. The manufacturers, the Penberthy Injector Co., established a factory at Windsor in the spring of 1887, and by making a simple and reliable injector, and one that in price was much less than others before used, have placed about 8,000 in the Canadian market, and in the same length of time over 40,000 in the United States, an output unprecedented in the history of injectors. They report the spring trade thus far more than double that of 1890, and they are at present supplying some of the largest manufacturers of portable and traction engines in the Dominion, as will be seen by reference to their advertisement in this issue. Their factory which they supposed would accommodate their trade, is now found to be totally inadequate for the output, and they are about to enlarge the same to double its present size. The office of this company is at Detroit, Mich., where all communications should be addressed.

Explosions from Unknown Causes.*

By J. C. Bayles, East Orange, N. J.

The most unsatisfactory occurrences in the experience of a manufacturer are those from which he suffers damage and learns nothing useful. That there are such incidents, and that they occur with annoying frequency, is unfortunately true. An accident which can be understood and explained always carries some consolation with it. However bad the consequences, one finds comfort in reflecting that they might have been worse, and that the knowledge of how to avert a more disastrous calamity from the same cause is worth what it cost. But when an accident occurs, which remains unexplained after anxious days of investigation and sleepless nights of reflection, and which is as liable to occur twice or twenty times, as once, very little satisfaction of any kind can be extracted from it by the most philosophical victim. Three such incidents have come under my notice in one establishment. Fortunately none of them were attended with very serious consequences, as no one was hurt, and the damage to property was slight; but in each instance, loss of life and great destruction were escaped by so narrow a margin as to make them extremely disquieting. I have recorded them in the hope, that from the experience of others may be gained what my own careful investigations have failed to reach—satisfactory explanations.

The first of these curious occurrences was the bursting of a 16-inch pipe carrying air under a compression of about 1 pound. The pipe was made of light galvanized iron with soldered seams. Into it a rotary fan-blower delivered air, and from it smaller pipes were carried to the furnaces. The blower was run continuously. Neither the main pipe nor its branches had any connection with the gas conduits. Both air and gas pipes delivered into the furnaces; but although the gas was under much higher compression than the air, there appeared to be no good reason why, having free escape in case of leakage, it should ever make its way back into the air pipe. One warm afternoon in June the main air pipe exploded with great violence. Every window in the mill was blown out, a considerable section of the roof was raised an inch or two, and in several places it was broken through. The pipe was torn into a thousand pieces, and a waggon load of fragments not larger than my hand were scattered all over the mill. Several of these fragments were driven edgewise into the roof timbers. The disk closing the end of the pipe was projected against a brick wall with such violence that it remained fastened in place, and is there yet, a mural tablet commemorating the event.

I promptly investigated the accident and learned the following facts: The pipe in which the explosion occurred extended the whole length of the mill. The machines then in use were placed together near the end connected with the blower, leaving some 80 feet of what may be called dead end. It was in this dead end that the explosion occurred. The portion of the pipe from which outlets were taken was substantially uninjured, but 75 feet of the 80 feet beyond the farthest outlet were utterly destroyed. The fact that, with very little mending, the part of the pipe which the explosion had not reached continued for some months to supply the machines with air, shows how local the explosion was; and the damage to the mill building gave sufficient evidence of its violence.

The natural explanation of this explosion is that gas found its way into the air pipe and was packed away in the dead end, and that when mixed with air in explosive proportions, it reached a furnace and exploded. I can only say that the most rigid investigation failed to explain how the gas got into the air pipe against the pressure it carried, and why an explosion beginning at a furnace should have restricted its effects to the dead end of the air pipe. It was undoubtedly a gas or vapor explosion, but I can find no other explanation of the presence of gas or vapor than that it was formed by the volatilization of the oil consumed in lubricating the trunnions of the blower. It is conceivable that the large amount of oil consumed by the blower is volatilized, and that it becomes a hydrocarbon gas which would behave like any other gas of similar composition. This gas, being lighter than air, would occupy the upper part of the pipe, and remain undisturbed, while air was drawn from outlets taken from its underside. This light gas may have worked along and accumulated in the dead end of the air pipe until it reached, in admixture with air, the explosive condition. But whence the spark? And why, if fired by a furnace, was the destructive force of the explosion exerted so far from the point of ignition? This hypothesis assumes that the volatilized or gasified oil of many days' running would remain undiffused for as many nights, until its accumulated volume was great enough to explain the phenomena of the subsequent explosion. The best that can be said of it is that, perhaps, it is better than no theory at all.

Nothing similar has occurred since. We replaced the galvanized iron pipe with a 16-inch steel tube, 400 feet long, to meet the increased requirements of the establishment. All the other conditions remain the same, except that a small opening was left in the end of the pipe which cannot be wholly closed. Whether this is necessary we do not know. The accident taught us nothing whatever; and, so far as we are aware, the same causes are now at work, and may at any time produce like results. The fact that no great damage was done is due to the frail character of the tube in which the explosion occurred. If the 16-inch steel tube should ever be destroyed with equal thoroughness by such an explosion as I have described, I hope I shall be in another State.

The second of the curious actions I shall mention was the explosion of a No. 6 Sturtevant blower. I was a witness of this amusing, though somewhat alarming, occurrence, and can speak of it from personal knowledge. The blower was inside the mill, and was driven by two belts from pulleys on the main line of shafting. It was used to furnish blast for the gas-generators. Some trouble with the main driving-belt necessitated a stoppage of the mill-engine, and the blower stopped. In a few minutes the engine started again, and with it the blower. It had been long in other use, but as this was its first day of service in that position I was naturally curious to see how it worked. So I stood watching it. Suddenly it disappeared. One side passed close to me and lodged against a post. Fragments weighing twenty to fifty pounds were distributed in all directions. The explosion was accompanied by a violent report and succeeded by a dense cloud of yellow-brown, offensive-smelling smoke, which rose to the roof, rolled right and left, and finally escaped at the monitor.

Again I investigated, until there remained no questions to ask. That it was not a centrifugal rupture I know without being told. The conclusion was that during the stoppage of the engine some air-gas from the producers had worked back through the pipe into the blower. When the blast was resumed these products of imperfect combustion were carried with the air-current into the producers, and being mingled in explosive proportions had been fired by contact with the incandescent fuel and exploded. This explanation was never quite satisfactory to me. An explosion which began in the producer could only reach the blower through two branches of a tee, six feet of vertical pipe, an elbow, twenty-five feet of horizontal pipe under ground, another elbow, six or eight feet of vertical pipe, another elbow, and four feet, more or less, of pipe conected with the outlet of the blower. Some of these pipes were light and some heavy, and the section underground was much larger then the section at either end of the run. If an explosion violent enough to wreck the blower completely had occurred through the whole length of this very circuitous pipe, I should have expected to find some evidence of it in the pipe itself. It was intact. Not a joint was started. Furthermore, as the blower had been running at least four minutes immediately before the explosion, what could have remained in it to explode? The fact was, however, that the blower was shattered, while the pipe was undisturbed, even the delivery-nozzle of the blower remaining coupled to the length of pipe on the mill-floor, which was not thrown out of line. As in the first instance, this explosion taught us nothing.

The third of the series of unexplained accidents consisted of two explosions following one another so closely and under conditions so nearly identical that they may be considered as one episode. In the purification of gas we use purifying boxes of the usual pattern. We have four boxes so connected by the centre-seal that we can throw any one of the four out of use when it is necessary to clean it. The gas always passes through three boxes before reaching the gasometer, and one is always kept ready to be filled with fresh iron and brought into use when needed. When the gas shows the presence of impurities or diluents it is time for a change. To make the procedure clear, let us suppose the boxes to be numbered 1, 2, 3 and 4, and the gas to be passing through 1, 2 and 3 in the order stated. No. 1 would, of course, become foul first, as it first receives the gas. If a test of gas which has passed No. 3 shows that it is not completely purified, No. 1 is cut out and No. 4 brought into use. The gas would then go through Nos. 2, 3 and 4 in the order stated, and No. 1 would be emptied and refilled in readiness to become the third of the series when the fouling of No. 2 made it necessary to pass the gas through Nos. 3, 4 and 1. In reality, the box to be brought into use is not refilled until it is needed, but otherwise the procedure is as I have described.

One day the superintendent and the manager had occasion to go into the purifier-house together and while there the superintendent tried the gas. Getting a reaction indicating the presence of impurities, and finding the fourth, or idle box, ready, he turned the centre-seal, cutting out the box which had been the first to receive the gas, and making the clean box the last of the series. The cap of the outlet was left off for the escape of the air, and not screwed on until there was a strong smell of gas, indicating that the air had been expelled. The same thing had been done in the same way hundreds of times. In two or three minutes the third box exploded with great violence. The cover was wrenched loose from the four clamps holding it down; carried up through timbers and roof and dropped again, badly wrecked. The centre-seal was canted to one side, allowing a copious escape of gas. The building took fire, and a second explosion in the basement blew out about half the foundations. The second explosion was easily understood. Fortunately, fire-extinguishers and hydraulic jacks saved the building, and except the need of repairing the broken box, the damage was slight. I at once began an investigation, which has lasted ever since. The explosion was undoubtedly due to the ignition of a mixture of gas and air in the box; but how was it ignited? The gas, before reaching the box in which the explosion occurred, had passed through the hydraulic main, two scrubbers, more than 500 feet of unjacketed pipe, and two purifying boxes, each containing three layers of wet sesqui-oxide of iron. It requires a violent stetch of the imagination to believe that a spark could travel so far under conditions so adverse. The pipe which delivers gas to the boxes is rarely quite cold, but I have never found it more than warm. The tops of the boxes are always cold and the gas enters the gasometer at atmospheric temperature. While we were speculating as to the cause of this accident, and congratulating ourselves that it was never likely to happen again, another box, the third of the series in use, exploded under exactly similar conditions. A detailed account of one explosion describes the other perfectly.

Matters were getting serious. No one had been hurt; but it was not impossible that the thing would happen under conditions which could not fail to kill somebody. I must find out what was wrong and correct it. So I called in all the experts I could reach. Some were honest enough, after looking the plant over, to confess that they had no explanation to offer. Others gave reasons which would have been satisfactory had they not been at variance with the facts. For the information of those who may be disposed to speculate as to why these boxes exploded, I may say:

1. The hydraulic main is modelled after the best gas works practice.
2. The scrubbers are adequately supplied with water.
3. The iron in the boxes which exploded was found, on analysis, to contain less than nine per cent. of free sulphur, and is still in use
4. The iron was adequately revived before being replaced, and did not heat in the boxes. After the explosion it was found to be cold.
5. The iron was sufficiently wet.
6. There was no fire in the purifier-house and "no smoking."

Since these two explosions, which occurred in April last, we have had no trouble. There has been no change in the arrangement of the gas plant, for we can discover no way to improve it.

It would have been a great satisfaction to have been able, in these instances, to follow the sage advice of Hotspur, and out of the nettle danger pluck the flower of safety. But our nettle crop does not seem to be of the flowering variety. If I had investigated less closely I might have reached satisfactory conclusions—perhaps of no more value, however, than the honest doubts I am now willing to confess.

◆

The Progress of British Coal Mining.—In a paper on "Coal Mining in 1850 and 1890: A few Contrasts," read recently by Mr. James Tonge, F.G.S., before the Manchester Geological Society, some interesting comparisons were made: In 1851, rather over 50,000,000 tons of coal and other minerals were raised; in 1889, 185,187,266 tons. In 1851 there were 216,217 persons employed above and below ground; in 1889 there were 563,735 persons employed. In 1851 there were 984 deaths caused by accidents in and about mines, being at the rate of 4.56 persons per 1,000 employed; in 1889 there were 1,069 deaths caused by accidents, being at the rate of 1.88 persons per 1,000 employed. The winding arrangements in 1850 were often of the crudest. Then it was not uncommon to see single engines used to wind the coal, and to raise and lower the workmen, and the cases were not at all infrequent where the engine was only just equal to its work under ordinary circumstances, and if there should be an unexpected weight at the end of the rope, the engineer had great difficulty in starting his engine, not being able to lift the load from the bottom, and at the same time put motion into the fly-wheel, and cases were quite common where the engineer, after vainly attempting to get "over the centre," came to the engine-house door and called to the banksman to come and assist him, this they did by lifting at the fly-wheel, some by hand and some by crowbars or other levers. Now, in most cases, the engines are sufficiently powerful and coupled, so that the difficulty of centreing is never experienced, the engines starting off with the greatest ease. In 1850 the winding ropes were in many cases made of hemp, sometimes 5 in. broad, and where the engine-house and pit were at a considerable distance from each other, it frequently happened that the wind had much effect upon the rope. In 1850 the underground apparatus for hauling, viz.: tubs, trolleys, rails, &c., were of the most meagre description. The rails were simply pieces of angle iron, with holes at the end. adapted for what were called "pancake wheels." Yet, even these were such an improvement upon the barrow and other previous makeshifts, that a grateful miner poured forth his thanks in verse.

"But heavy puttin' 's now forgotten
  Sic as we had i' former days;
Ower holey thill an' dylls a-splittin',
  Trams now a-run on metal ways."

"God bless the man in peace and plenty
  That first invented metal plates;
Draw out his years to five times twenty,
  Then slide him through the heavenly gates."

"For if the human frame to spare
  Frae toil an' pain ayont conceivin',
Hae aught to dae wi' gettin' there,
  I'm sure he maun gan' strite to heaven."

◆

Rock Blasting by Electricity—Messrs James Macbeth & Company, 128 Maiden Lane, New York City, have just issued a neat little pamphlet on "Rock Blasting by Electricity," together with illustrated catalogue and price list of Victor Elastic Platinum Fuses, electric blasting machines, electric fuse and blast testers, wire reels, battery testers, insulating tape, leading and connecting wires made by them. The text, which shows evidence of being carefully prepared, is generously illustrated, and contains a great deal of valuable information for blasters in the use of the company's electric blasting appliances and rock blasting by electricity in general.

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*Transactions of the American Institute of Mining Engineers: New York Meeting, September, 1890.

IRON STEEL AND HEAVY METALS.

Iron and Steel.

Montreal, April 22, 1891.—No changes of any consequence have marked the course of the pig iron market during the past month. In the earlier part Scotch pig iron warrants fell to the lowest point they have touched for some time past, and were sold in the neighborhood of 42*s*., but since then there has been a reaction, and the price to-day stands at about 2*s*. per ton over the lowest point touched. It is difficult to give in advance any indication of the course of this market, but the quantity of warrant iron now in stock is comparatively small and easily handled, and could thus be manipulated by some speculative movement to a much greater degree than was the case a year or two ago when stocks amounted to over 1,000,000 tons. Against the possibility of any great advance, however, is to be put the fact that the demand is very small at present, and business in the iron trade generally extremely quiet, both in Great Britain and on the Continent. While prices may therefore advance somewhat from their lowest point, it is hardly possible we will see very high figures ruling this year. On this side of the Atlantic we find the same state of affairs among American producers of pig iron, and prices have touched their lowest figures. It is a question to-day whether the great bulk of American furnacemen are getting cost for their pig iron, and it appears certain that the southern brands, which have the advantage of being made where fuel and ore lie almost side by side, will have the advantage in this respect over their northern competitors. American iron is still being pushed in Canada, but at prices which would not be accepted from consumers in the United States, and it is evident that makers are doing their best to get rid of their surplus product on this side of the line. A fair business has been done in Scotch iron, and "Summerlee" has been placed for spring delivery on the basis of about $21.50 in Montreal, with such brands as "Carnbrae" and "Govan," at about $1.50 to $2.00 less. Stocks in yard are being considerably reduced, and very little will be carried over the present month. For stock lots prices still keep at $23.00 for "Summerlee," but the quantity available is extremely small. Spring business has, however, opened very quiet, and there is no appearance of any great demand for the next two or three months. This is owing to causes indicated in our last report, but the increase in the price of grain and the consequent clearing out of stocks held by the farmers, have made the situation rather brighter. In finished iron the market still remains the same, and it is questionable whether the present price of bar iron in England is remunerative to the producers, on account of the abnormally high price of coals. Canadian bars are still being sold at $2.10 in Montreal with English brands at $2.25. The tin plate market is in a very peculiar position owing to the fact that while present figures are about $4.50 to $4.75 for cokes, orders are being booked for delivery after the month of July, at about 75c. to $1.00 per box less. It is questionable, however, if prices will reach the low point many people anticipate, as it is rumored that some of the works which have had more business than they could handle during the past year, will close down for a season after the American demand has been supplied. It is likely also that they will now give their attention to the manufacture of Canada plates, which will be wanted as usual for the fall trade on this side. Copper has been sold at very low figures in the United States lately, and the same weakness has marked the market on this side. In zinc and spelter prices have been somewhat weaker and reports from the other side point to lower figures.

London, April 13, 1891.—There are rumors of a further attempt towards the creation of a "corner" in Scotch warrants, and certain transactions which have been concluded during the week give color to the reports. The movements of the Glasgow operators have been duly reflected in London, and at times the effect has been to make buying in London, even at top prices, so difficult that rates have been somewhat in advance of those ruling in Scotland. The scarcity of cash iron has attracted some amount of attention, but operations have been confined to a limited range. On the London Exchange on Friday of last week the reported business was limited to some seven or eight warrants, most of which were done in the afternoon. Scotch cash realized 42*s*. 7*d*. in the first 'Change, but declined 1*d*. in the afternoon. For a month business was neglected, but for the end of May 42*s*. 9½*d*. was paid. Monday was a blank, both morning and afternoon, with quotations at 42*s*. cash and 2*d*. more a month, Scotch, 37*s*. 9*d*. Middlesborough cash, and 46*s*. 11*d*. hematite cash. Tuesday morning was another blank, with Scotch nominally declared at 42*s*. 3*d*. cash, and 1*d*. more a month. In the afternoon two or three Scotch warrants were turned over on the basis of 42*s*. 4½*d*. for a few days short of a month. Both Middlesborough and hematite were neglected, the former at 37*s*. 8*d*. and the latter at 46*s*. 11*d*. cash. Wednesday morning's market was inactive, only one warrant having been done for a month at 42*s*. 8½*d*. In the afternoon four or five warrants changed hands for prompts falling due the last week of the present month at 42*s*. 7½*d*. to 42*s*. 8*d*. Middlesborough iron advanced 1*d*. and hematite 2*d*. on the respective quotations of the previous day, Thursday morning cash was in demand, and sellers obtained 42*s*. 8½*d*. to 42*s*. 9*d*. cash, and 42*s*. 10*d*. a month. In the afternoon there was an easier market, with cash at 42*s*. 6*d*., and a month 42*s*. 8*d*.

Scotch Pig Iron Warrant Market.—Appended is our usual table of quotations and statistics :—

	1891.	1890.	1889.	1888.	1887.
Scotland.					
Price of Scotch warrants, Apl. 7	42/5	49/6	44/9	39/-	41/4
Furnaces in blast in Scotland, April 7	41	89	82	87	77
Quantity of iron in public stores	524400	819951	1031727	969467	859770
Shipments of Scotch pig iron for week ending April 4.	4191	12275	6213	6412	6955
Do. since beginning of year..	54443	111905	106011	92519	105072
Middlesboro' iron imported at Grangemouth, week ending April 4	7110	3425	9987	7795	7030
Do. since beginning of year..	93647	35685	106279	98469	97603
Cleveland.					
Price of Middlesbro' No. 3, warrants on April 7	37/10	52/-	39/-	31/11	34/-3
Furnaces in blast in Middlesbro' district..	94	105	101	96	91
Quantity of iron in public stores*	122839	147772	249205	323712	336819
Shipments of pig iron from Middlesbro' for week ending April 4	14920	24657	29890	19586	14380
Do. since beginning of year..	195126	168533	250230	227141	190898
West Cumberland and North Lancashire.					
Price of hematite M/Nos. warrants	47/-	58/7½	49/-	42/-	43/6
Furnaces in blast in W. Cumberland and N. Lancashire	40	52	44	50	51
Quantity of iron in public stores†	177943	363067	424122	439610	313057
Shipment of hematite iron for week ending April 4	12155	10000	10356	11570	12602
Do. since beginning of year..	132514	154207	144120	122864	142038

* Connal's & N. E. Rly. Co's.
† Workington, Maryport, and Barrow.

New York, April 20, 1891.—The iron market has been generally dull and featureless with little change since our last, the only exception being steel rails, for which quite a number of orders have been placed by various railroad companies. Rolling mills are holding prices firmly at $30 at the mills. In other branches of the trade business has been entirely of a routine character. Buyers have been in the market only to fill immediate wants, evidently feeling confident of being able to secure all the iron they require at any time in the immediate future, and possibly at still lower prices. There is no pressing for sales on the part of sellers, however, although supplies are ample, and prices are firm with no concessions. There does not appear to be much probability of any change from this state of affairs for a few weeks yet. Any improvement in the general business situation of the country with the consequent increased demand for iron, which is the only thing that can help the market, must of necessity be gradual. On the other hand the production of pig iron has been reduced to such an extent that it is not likely that it exceeds consumption greatly at the present time, and if no more furnaces blow in, prices should remain about where they are now. The number of furnaces in blast is not likely to increase, as the profits at present prices are virtually *nil*. In pig iron trade has been dull and of a hand-to-mouth character. We quote : Northern, No. 1 X, $17.50@$18 ; No. 2 X, $16.50@$17. Sales of warrant iron have been reported in the South at very low figures, $9.60 being the best bid for grey forge, Birmingham delivery. There has been very little doing in either spiegeleisen or ferro-manganese. Spiegeleisen, 20%, is quoted nominally at $27.50@$28.50 ; 80% ferro-manganese, $63@$64.

Cleveland, O., April 20, 1891.—The pig iron business is depressed, and the only apparent cause is a lack of confidence on the part of consumers in the stability of present conditions, although it would be hard to imagine a much better opportunity for placing large orders. The reports of the Western Pig Iron Association up to date show a reduction, during the past thirty days, of some eighty thousand tons of pig iron, leaving on hand total stocks of about 250,000 tons. Of this reduction, some twenty-eight thousand tons are credited to the Shenango Valley and the Pittsburg district, and only four hundred tons to the Mahoning Valley. It follows without saying that there must have been a large falling off in consumption somewhere. And that is the case right here, at home. There has been no practical change in the coke situation. A little coke is being made, mostly for the Pittsburg market, and a small percentage of this supply finds its way to Cleveland, for the use of the furnaces above referred to. The threatened coal strike is apt still further to complicate the situation, in that it may lead to the shutting down of the mills within a week or two after its commencement, and so add to the lack of production even of manufactured material. Some of the foundries report business very brisk, while others, apparently on the same footing, report no business at all ; but even those now engaged in turning out work have no employment beyond a week or two, while a year ago they were loaded up with orders for three or four months ahead. Bar iron is generally held at $1.60, but lower quotations obtain, here and there, for small lots, and for immediate consumption. Looking at the situation in the light of all that has been said, the outlook is anything but cheerful for all the lines entering into, or intimately connected with the ore and pig iron business. The only satisfaction that may be expressed is that arising from the fact that no worse can befall the market than what has already happened, so that the possibly worse horoscope is discounted in advance.

Copper.—There has not been a great deal of change in the situation of copper since our last, if anything it is a little weaker both in the American and European markets. In the former it is now easily obtainable at 13¾c. from first hands, but no concessions have been made below this. There is very little second-hand copper about, and the large companies are receiving orders for fair amounts. It is anticipated that before long a number of manufacturers and consumers will come into the market pretty freely. Rail and water shipments from the Lakes will soon be resumed, which will bring the cost of copper down about ½c. per lb. The Anaconda mine still remains closed, and it is as yet unknown when it will be re-opened. The European market has been slightly depressed and prices have weakened off a little. Chili bars are somewhat lower, closing at £51 5*s* @ £51 7*s*. 6*d*. spot, and for three months prompt, at £51 10*s*. @ £51 12*s*. 6*d*. The visible supply for the first half of the month has increased 1,200 tons. It is estimated that 500 tons monthly will be shipped from Chili, which means a diminution of about 2,000 tons monthly, which, with the closing down of the Anaconda, should have some effect on statistics before long. We quote : Tough copper, £53 15*s*. @ £54 ; best selected, £55 15*s*. @ £56 ; strong sheets, £60 @ £61 ; India sheets, £58 @ £58 10*s*.; yellow metal sheets, 5¾*d*.

Lead.—The lead market has been depressed in the United States ; recent sales have been made at 4.20c. and as low as 4.15c. in New York. A new decision has been rendered by the Custom House appraisers on the valuation of lead in silver ores, which hitherto has been taken at 1c. below the price of pig lead ruling in New York. Satisfactory proof having been given the board that the above was unjust and did not allow for freight and smelting charges, a price of about 1¾c. below the price ruling in New York has now been adopted. This will allow larger quantities of Mexican silver ores to come into that market. Consumption so far has not been very good, and in some quarters production seems to have somewhat increased, though not to any great extent. In St. Louis lead has been weak and lower, common having sold as low as 3.95c. prompt delivery. In London Spanish lead is quoted at £12 12*s*. 6*d*., and English at £12 15*s*.

Nickel.—There is very little doing at present in nickel ; the metal is scarce and quotations are steady at 67½c. @ 70c.

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The Composition of the Ore Used and of the Pig Iron Produced at the Radnor Forges.

By J. T. Donald, M.A.

The St. Maurice and the Radnor forges, situated in the vicinity of Three Rivers, are of interest to those interested in the development of the iron industry in Canada, as well as to the student of the history of the early colonists of the Province of Quebec. These forges are at present the property of the Canada Iron Furnace Company, Limited, and the managing director of this company, Mr. Geo. E. Drummond, has kindly furnished the following historical note : "The value of the Three Rivers ores has been known since a very early period in the history of Canada. Official examinations were made by order of the Government of France as far back as 1668 ; tests of the ore were made before the year 1700, and finally in 1737 a company was formed to erect a furnace and commence the manufacture of pig iron. The Government of France seems later on to have gained control of the work, for in 1752 the St. Maurice furnace (erected and operated by the Government) was blown in, and the old stone stack bearing date 1752 and the Government insignia, the Fleur-de Lis, still remains to dispute with that of Principio in Maryland, the right to be considered the oldest in America, At that early period upwards of 300 men were employed under directors who had obtained their skill in Sweden. According to the reports of Colonial Secretary Tranquet, works were carried on with much success. In addition to pig iron, wrought iron of high quality was manufactured from the product of the bog ore; shot and shell were cast, and pigs and bars were even exported to France, After the conquest the works were leased to private parties, and since then have passed through many hands.

"Many samples of the articles—notably stoves—manufactured from the pig iron made in those early days, still remain to attest the high quality of the iron."

The furnace at Radnor, though similar in construction to that at St. Maurice, from which it is only four miles distant, was erected at a much later date, and in some respects it may be considered the successor of the old St. Maurice furnace. At present the latter is idle, but that at Radnor is in blast. Recently, the ore used and the pig iron produced in this furnace have been analysed. The ore is a mixture of equal parts of the bog ore of the neighborhood and of the curious "lake ore" from Lac la Tortue. An average sample of each was submitted to analysis, and the results are given below:—No. 1 is the bog ore, No. 2 the lake ore, No. 3 is a lake ore from the same locality, analysed by Mr. W. A. Carlyle, B. A. Sc., some three years ago:—*

COMPOSITION OF IRON ORE.

	I.	II.	III.
Ferric oxide	60·74	70.04	69·64
Ferrous oxide	....	....	0·72
Manganic oxide	1·18	1·78	2·99
Alumina	2·59	2·20	2·43
Lime	3·47	0·32	....
Magnesia	0·93	0·27	0·60
Phosphoric anhydride	0·69	0·76	0·47
Sulphuric anhydride	0·19	0·23	0·09
Silica	13·94	7·84	8·17
Loss on ignition	16·49	16·84	15·00
	100·22	100·28	100·11
Metallic iron	42·52	49·03	49·31
Phosphorus	0·302	0·331	0·205
Sulphur	0·078	0·093	0 036

The close correspondence between Mr. Carlyle's analysis and that of the writer would seem to indicate that this Lac la Tortue ore is of fairly uniform composition over a considerable area.

The Radnor furnace charge consists of 840 lbs. of the mixed ore, 84 lbs. of limestone and 32 bushels of charcoal; the blast used has a pressure of three-fourths of a pound, and ranges in temperature from 300° F. to 450° F. The yield of iron is on an average 42-43 per cent. of the weight of ore used. The iron sent for analysis consisted of sections of two pigs of different degrees of hardness, and produced at different times. Nos. 1 and 2 are the Radnor irons, No. 3 is Dr. T. Sterry Hunt's analysis of a specimen of gray pig made at St. Maurice in 1868:—†

COMPOSITION OF PIG IRON.

	I.	II.	III.
Iron	94·375	96·302	Undet'd
Carbon	·378	·336	1·100
Graphite	1·904	1·796	2·820
Silicon	1·379	·485	·860
Sulphur	·062	·049	·025
Phosphorus	·464	·430	·450
Manganese	1·145	·895	1·240
	90·707	100·293	

◆

Toughness of Cast Iron.—Some interesting tests of cast iron produced at one of the great stove manufactories in Albany, N.Y., have been made. The pieces were 1 inch in width, ⅛ inch thick, and between 15 and 18 inches long. Of these strips, some were twisted so as to form spirals, and others were wrapped upon coils. That cast iron can be made very tough, and even a certain amount of elasticity be imparted to it, is, of course, well known, but it is unusual, if not unprecedented, for any metal employed in stove foundries to bear such tests as those thus indicated. The twisting and bending in this case were done hot, there being nothing in the specimens but a judicious mixture of good irons and the absence of old scrap—the fact being also stated that the irons in question represent the daily meltings of the foundry from which they came, all the stoves produced there having their plates of the same metal which exhibits this peculiar toughness. It is not asserted that, because the metal will bear a torsional strain of the kind described, it is, therefore unbreakable, there being, of course, a limit to its remarkable elasticity.

A Big Business.—The Lidgerwood Manufacturing Company of New York, Chicago and Boston, the well known makers of hoisting engines, sold during the year 1890, 1,105 engines and 588 boilers. This shows an average output of nearly 4 engines and 2 boilers per day. They are preparing a new catalogue which will contain illustrations of many new hoisting engines, and in which considerable space will be devoted to suspension cableways—a new feature of their business.

Cast Iron Car-Wheels.—There has been a great deal said about the mileage of wheels which were made by the various car-wheel foundries, and the merit of certain mixtures or specific methods of producing wheels has been largely proclaimed. On the other hand, there has been a very severe duty-test assigned to wheels by the users of them, a test none too hard, in view of the fact that so many lives and so much property is put in jeopardy by every imperfect car-wheel; but there has, no doubt, been some hardship in the interpretation of responsibility which called out, at the meeting of the Manufacturers of Chilled Car-Wheels at New York last Fall, a protest, on account of the wheel-makers having no control over the condition of railroad service, which took the form of the following resolution:—

"*Resolved*, 1. That in all mileage on time guarantees, the wheel-maker ought to be held responsible only for wheels which fail through faults of material or workmanship.

"2. That, where wheels are taken out of service on account of sharp flanges, flat spots, comby or shelled out treads, or for cracked brackets or plates, and it is found on breaking up the wheels that the depth and character of the chill, and the strength and character of the metal in the plates are up to the standard specifications adopted by the Joint Conference Committee of the Railway Master-Mechanics', the Master Car-Builders' and the Wheel-Makers' Associations, it shall be considered that the failure is due to the service and not to the quality of the wheels, and that the wheel-maker ought not to be called upon in such cases to pay for or replace any such wheels."

In the matter of tests of wheels a statement is presented, issued by Messrs. A. Whitney & Sons, of Philadelphia, giving the results of inspections and tests of 10,000 wheels from their foundry, made between March, 1889, and March, 1890, by the R. W. Hunt & Co. Bureau, of Chicago, and we give the record of this inspection to show the perfection to which the casting of car wheels is now being carried.

Each wheel was measured around the tread by a brass tape, the record showing that 4,325 were all of exactly the same circumference; 4,365 were all of exactly the same circumference, but one-eighth inch less than the 4,325; 881 were all of exactly the same circumference, but one-eighth inch more than the 4,325; 429 varied one-eighth of an inch either way from the above.

Out of the 10,000, the extreme variation in 8,690 was only ⅛ of an inch in circumference, or $\frac{1}{24}$ of an inch in diameter, and in 881 more it was only ¼ of an inch in circumference, or $\frac{1}{12}$ of an inch in diameter.

Tested by a true ring resting on the cone of the wheel, not one was found with a variation of more than $\frac{1}{32}$ of an inch from the ring at any point.

To test the strength, the specifications required that one wheel out of every 100 ready for shipment, should be broken by a drop of 140 pounds weight falling twelve feet, and that it should stand five blows without breaking into two or more pieces. For the 10,000 wheels shipped, 105 were broken, with the following results:—

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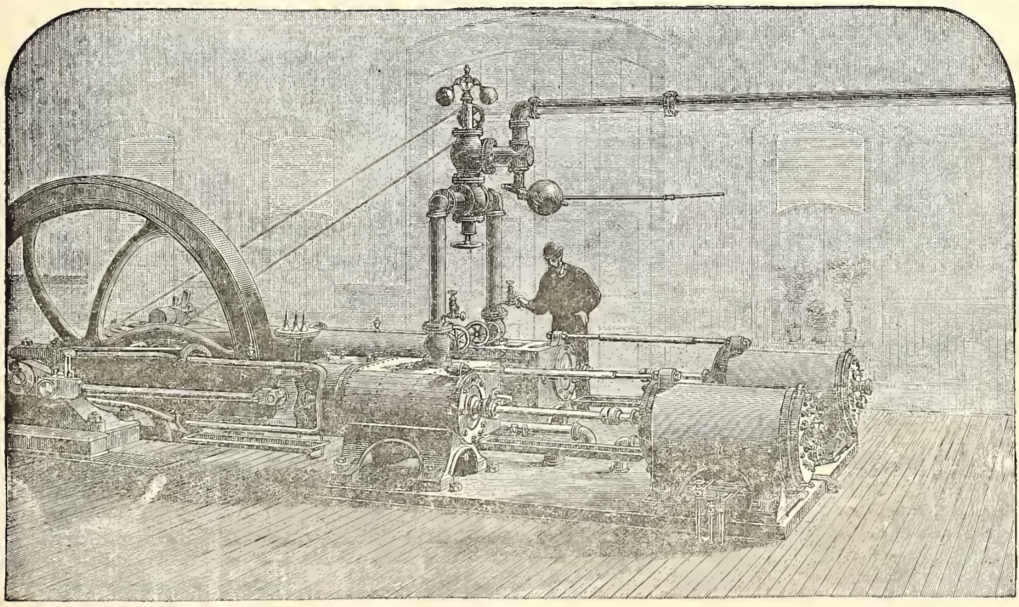
* Canadian Record of Science, Vol. III., No. 1, p. 43.

† Report Geol. Survey, 1873-74.

THE CANADIAN RAND DRILL COMPANY,
SHERBROOKE, QUE.



THE ABOVE CUT illustrates our DUPLEX AIR COMPRESSOR, which in the United States has become the Standard Machine for permanent plants where economy of fuel is sought.

We also build Straight Line Compressors—the best of their class—for Contractors' use and for Exploration work where low first cost and semi-portability outweigh considerations of economy of fuel.

All our Compressors are now fitted with our positive-motion Air-Valves, the only real improvement that has ever been made over the old Spring Valves.

To start the first crack, the average number of blows was $13\frac{26}{105}$.

To start the first crack, the weakest required 5 blows, and the strongest 58.

To break the wheel in two, the average number of blows was $49\frac{56}{105}$.

To break the wheel in two, the weakest required 9 blows and the strongest 118.

(Two wheels broke at 9 blows, fifteen between 10 and 20, four between 20 and 30, thirty-four between 30 and 50, and fifty between 50 and 118 each.)

The Messrs. Whitney say, that the average depth of chill at the root of the flange in the 105 wheels broken, was $\frac{7}{16}$ of an inch, and the depth did not vary, in any case, more than ⅛ of an inch around the wheel.

In reference to the contracting-chill, we take this opportunity of quoting from a communication to the *National Car and Locomotive Builder*, in which Mr. John R. Whitney discussed the behaviour of iron in solidifying.

"For the 'whole' casting, the process of solidification is a gradual one, and with some irons it is much more gradual than with others. But it does not follow from this that a casting 'will, from the moment the mould is filled or poured till it has reached, as a casting, its lowest point of temperature, be all the time constantly shrinking and contracting so as to occupy less space.' If it did, in every casting, and especially in every one of any considerable size, the centre ought to be the most intensely compressed part, as it is the last to reach the 'lowest point of temperature,' and therefore should show the finest and closest grain. But we do not find it so. The centre always shows the largest and most open grain. If, however, as each successive portion becomes solid, its contraction is resisted and prevented by expansion of each successive portion in becoming solid, the open-grained centre is easily and satisfactorily explained.

"On a recent occasion, the following experiment was made with a carefully prepared apparatus. A pattern, 4 feet long, 3⅞ inches deep and 2¾ inches wide was moulded in the open sand, one end of the mould being closed by fire-brick and the other end by a piece of gas-carbon, which was suitably connected with a small battery and galvanometer. The fire-brick rested at one end against a block of iron weighing about half a ton. The gas-carbon block was carefully secured in the sand, so that the weight of iron in the mold should not be sufficient to move it, and the stand, bearing an arm on which a pointer was delicately pivoted, was then adjusted, so that the needle should press against the gas-carbon, and the pointer stand at zero on the scale. The long arm of the pointer was 24 inches and the short one 6 inches long, or, as 1 to 4. The scale was graduated to $\frac{1}{16}$ of an inch.

"The mould was filled with very fluid hot iron in seventeen seconds, and then the following results were carefully noted :—

For more than

	1′	after the mould was filled, pointer stood at zero.						
At	1′ 30″	"	"	"	"	moved	$\frac{1}{16}$	inch.
"	1′ 50″	"	"	"	"	"	⅛	"
"	3′ 10″	"	"	"	"	"	¼	"
"	5′ 20″	"	"	"	"	"	⅜	"
"	8′ 5″	"	"	"	"	"	$\frac{7}{16}$	"
"	11′ 30″	"	"	"	"	"	$\frac{15}{32}$	"
"	12′ 5″	"	"	"	"	"	½	"

"At twelve minutes from that time, the pointer stood perfectly still at ½ inch until twenty-five minutes and fifteen seconds after mould was filled, when the galvanometer showed that contact with the gas-carbon was broken and shrinkage had begun.

"Long before these experiments were instituted, the fact that iron follows essentially the same law as water in solidifying, was well known and published. I need cite only two authorities. Professor Edward Turner, in his *Elements of Chemistry*, published in Philadelphia in 1835, says, p. 20: 'Water is not the only liquid which expands under reduction of temperature, as the same effect has been observed in a few others which assume a highly crystalline structure in becoming solid; fused iron, antimony, zinc and bismuth are examples of it.' Professor Thomas Graham, also, in his *Elements of Chemistry*, published in Philadelphia in 1843, says, p. 385: 'Iron expands in becoming solid and, therefore, takes the impression of a mould with exactness.'"—*Journal of the Charcoal Iron Workers.*

COMPETENT MINE SUPERINTENDENT WANTED.—A Company starting to open up an extensive deposit of iron-ore, desires the services of an experienced and competent Superintendent. Write, with particulars, to "L. D. F.," Canadian Mining Review, Ottawa.

THE FIRST QUARTERLY MEETING

OF THE

GENERAL MINING ASSOCIATION

OF THE

PROVINCE OF QUEBEC

WILL BE HELD IN THE

LADIES' ORDINARY OF THE WINDSOR HOTEL,

MONTREAL,

ON WEDNESDAY, 29TH APRIL, 1891.

Sessions for the reading and discussion of papers at 10 a.m. and 2 p.m. Annual dinner of the Association in the evening at 8 o'clock

A cordial invitation is extended to the general public to be present at all sessions of the Association.

HON. GEO. IRVINE, Q.C., *President.*
B. T. A. BELL, *Secretary.*

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EDISON BUILDING, BROAD STREET, NEW YORK.

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A recent test at Quincy, Mass., of one size of our Electric Percussion Drill showed it to be far superior to Steam or Compressed Air Drills.

In the exceptionally hard Quincy Granite, a hole 1.5 inches in diameter was drilled at the rate of 2.75 inches

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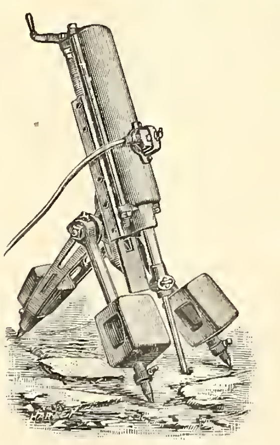

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per minute, with but 3 1-2 Horse-Power used at the driving-belt of Generator.

Drill was taken entirely apart and put together again in 10 minutes.

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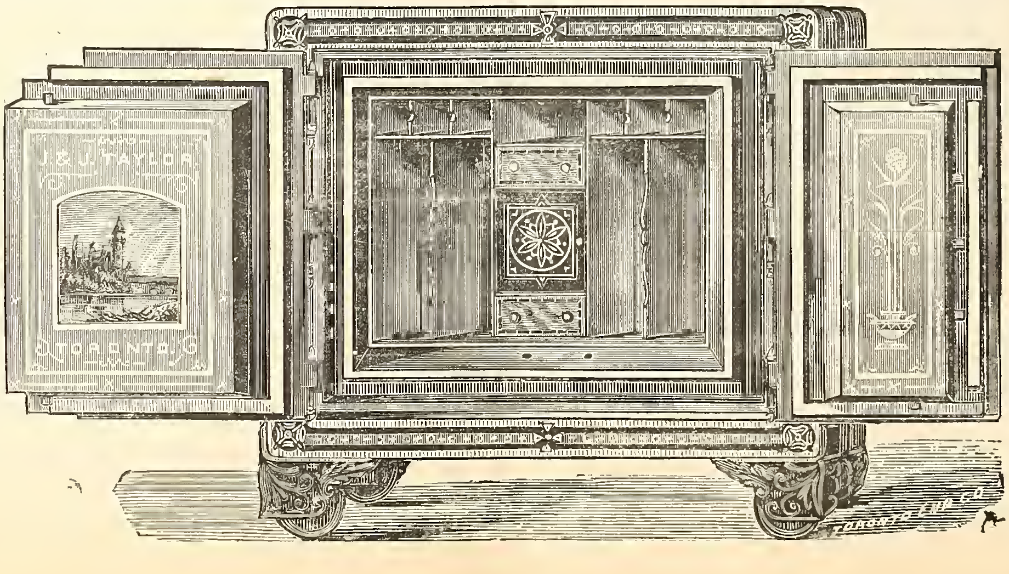

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Will act as permanent or special advising engineer to Companies. Advises on the working and management of mines and mills.

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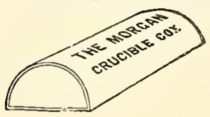
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All the principal buyers of furnace materials in the world purchase and pay cash against our certificates of assay, through New York banks.

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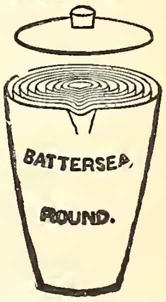

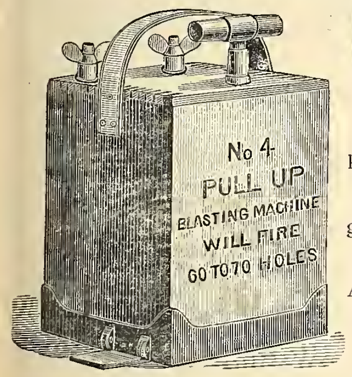

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Superior to all others for exploding any make of dynamite or blasting powder. Each fuse folded separately and packed in neat paper boxes of 50 each. All tested and warranted. Single and double strength, with any length of wires.

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Made in two sizes. No. 2 fires 20 to 30 holes. No. 1 fires 5 to 8 holes. Adapted for prospecting, stump blasting, quarry and general railroad work.

"PULL-UP" BLASTING MACHINE.
The strongest and most powerful machine ever made for Electric Blasting. No. 4 size fires 70 holes. No. 3 size fires 40 holes. Are especially adapted for submarine blasting and large mining works.

Standard Electric Fuse and Blast Tester, Wire Reels, new design. Leading and Connecting Wire.

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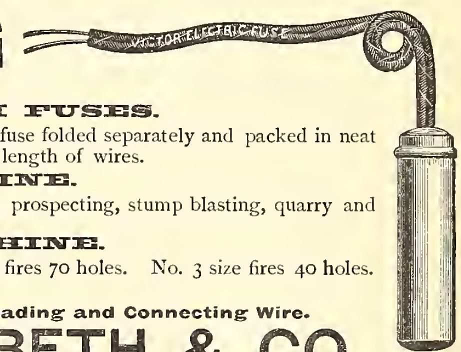

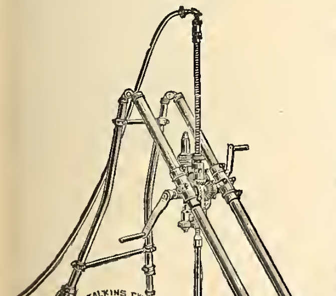

"M" Drill--Hand Power.

Capacity—300 ft. depth.

Removes $1\frac{3}{16}$ inches solid core.

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The Sullivan Diamond Drill is the **simplest, most accurate,** and **most economical** prospecting drill for any kind of formation, hard or soft, in deep or shallow holes.

The Diamond Drill brings to the surface a **solid core** of rock and mineral to any depth, showing with **perfect accuracy** the nature, quality and extent of the ore-bearing strata, and with great **saving in time and expense** over any other method.

Complete stock of all sizes, driven by hand or horse power, steam, compressed air or electricity. For sale by

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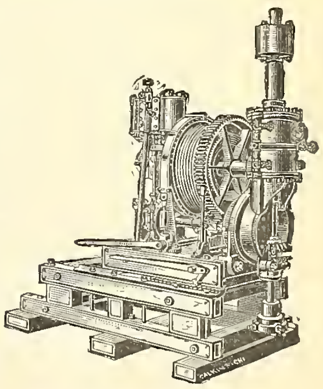

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Capacity—2,000 ft. depth.

Removes $1\frac{7}{8}$ inches solid core.

NOTICE—A Chemist and Mineralogist of standing will make a professional visit to British Columbia and the Pacific Coast in May or June. Any parties having mining claims they wish to have examined or reported on can communicate with him by addressing "Expert" Canadian Mining and Mechanical Review Offices, Ottawa, Ont.

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RECRUITS.

APPLICANTS must be between the ages of Twenty-two and Forty, active, able-bodied men of thoroughly sound constitution, and must produce certificates of exemplary character and sobriety.

They must understand the care and management of horses, and be able to ride well.

The minimum height is five feet eight inches, the minimum chest measurement 35 inches, and the maximum weight 175 pounds.

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1st year's service..	50c.	——	50c.	per day.
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MONEY ORDERS may be obtained at any Money Order Office in Canada, payable in the Dominion and Newfoundland ; also in the United States, the United Kingdom, France, Germany, Austria, Hungary, Italy, Belgium, Switzerland, Portugal, Sweden, Norway, Denmark, the Netherlands, India, Japan, the Australian Colonies, and other Countries and British Colonies generally.

On Money Orders payable within Canada, the commission is as follows :

If not exceeding $4	2c.
Over $4, not exceeding $10	5c.
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" 20, " " 40	20c.
" 40, " " 60	30c.
" 60, " " 80	40c.
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On Money Orders payable abroad the commission is :

If not exceeding $10	10c.
Over $10 not exceeding $20	20c.
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" 30 " " 40	40c.
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For further information see OFFICIAL POSTAL GUIDE.

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This Company will sell its instruments at prices ranging from $10 to $25 per set. These instruments are under the protection of the Company's patents, and purchasers are therefore entirely free from risk of litigation.

This Company will arrange to connect places not having telegraphic facilities with the nearest telegraph office, or it will build private lines for firms or individuals, connecting their places of business or residence. It is also prepared to manufacture all kinds of electrical apparatus.

Full particulars can be obtained at the Company's offices as above, or at St. John, N.B., Halifax, N.S., Winnipeg, Man., Victoria, B.C.

TENDERS.

SEALED TENDERS, addressed to the undersigned, and endorsed "Tender for Indian Supplies," will be received at this office up to noon of SATURDAY, 9th May, 1891, for the delivery of Indian Supplies, during the fiscal year ending 30th June, 1892, consisting of Flour, Beef, Bacon, Groceries, Ammunition, Twine, Agricultural Implements, Tools, &c., duty paid, at various points in Manitoba and the North-West Territories.

Forms of tender, containing full particulars relative to the Supplies required, dates of delivery, &c., may be had by applying to the undersigned, or to the Indian Office, Winnipeg.

Parties may tender for each description of goods (or for any portion of each description of goods), separately or for all the goods called for in the Schedules, and the Department reserves to itself the right to reject the whole or any part of a tender.

Each tender must be accompanied by an accepted Cheque in favor of the Superintendent General of Indian Affairs, on a Canadian Bank, for at least five per cent. of the amount of the tender, which will be forfeited if the party tendering declines to enter into a contract based on such tender when called upon to do so, or if he fails to complete the work contracted for. If the tender be not accepted, the cheque will be returned, and if a contract be entered into for a part only of the supplies tendered for an accepted cheque for five per cent. of the amount of the contract may be substituted for that which accompanied the tender; the contract security cheque will be retained by the Department until the end of the fiscal year.

Each tender must, in addition to the signature of the tenderer, be signed by two sureties acceptable to the Department for the proper performance of the contract based on his tender.

This advertisement is not to be inserted by any newspaper without the authority of the Queen's Printer, and no claim for payment by any newspaper not having had such authority will be admitted.

L. VANKOUGHNET,
Deputy of the Superintendent-General of Indian Affairs.

Department of Indian Affairs,
Ottawa, March, 1891.

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And all New England and New York points.

Baggage checked to all points and passed by Customs in transit.

For Tickets, Time Tables and information apply to nearest agent or to S. EBBS, City Passenger Agent,
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Gold Mine Wanted.—Submit report and alternative proposal either for cash or working capital only. Refractory ores no objection. Address "Reliable," care Mining Record, 61 Broadway, New York.

SUDBURY NICKEL LANDS

FOR SALE

A FIRST-CLASS INVESTMENT.

Several very valuable locations containing rich deposits of Nickel and Copper Ore, situate in the Townships of Moncrieff and Craig, in the Sudbury Mining District, Province of Ontario.

Mr. J. R. Gordon, C.E., who spent most of the season of 1890 investigating the nickel deposits in the vicinity of Straight Lake, a station on the main line of the Canadian Pacific Railway, about 47 miles west of Sudbury, reports very favorably of these properties. The deposits extend from about one mile north-east of the railway to about four miles southwest. Where the lode crosses the track in the Township of Moncrieff, the vein or deposit of nickel is nearly 20 feet wide. The vein varies in width from 10 to 20 feet, but in places is over 30 feet wide. At the western terminus of the lode in the Township of Craig, which is immediately west of the Township of Moncrieff, the width increases.

The Huronian rocks have been traced by Dr. Robert Bell, of the Geological Survey of Canada, for a distance of some three miles west of the Spanish River, and to South and West are gneiss formations.

In his paper published in the bulletin of the Geological Society of America, Dr. Bell describes this district "The Geneva Lake Outlier."

Plans, Experts' reports, and full particulars may be had by addressing

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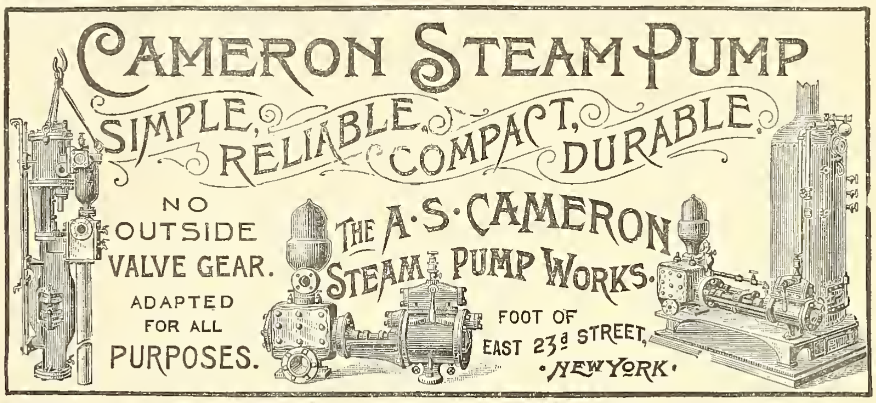
Mining claims examined. Reports rendered. Ores Assayed. Valuations determined. Sales of Mining Property negotiated.



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Iron Pipe, Fittings, Iron and Steel Boiler Plate and Tubes, Structural Iron of all kinds.
Every Description of Contractors' Machinery, and General Mining Outfits.

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WINDSOR FOUNDRY COMPANY

Windsor, Nova Scotia.

IRON FOUNDERS & GENERAL MACHINISTS.

Gold Mining Machinery a Specialty.

ESTIMATES AND PARTICULARS FURNISHED ON APPLICATION.

BOILER AND PIPE COVERINGS,

Absolutely Fire Proof.
Light and Easy to Apply.

Indestructible by heat; covering your Steam or Hot air Pipes will save from 10 to 40 per cent. in fuel, and give dry steam at long distances.

ASBESTOS SPECIALTIES.—Braided Packing, Mill Board, Fire Felt, Sectional Coverings, Asbestos Cloth, Asbestos Theatre Curtains, Asbestos Paper, &c., &c.

THE CHALMERS-SPENCE CO., - 59-61 LIBERTY ST., N. Y.

PROVINCE OF NOVA SCOTIA.

Leases for Mines of Gold, Silver, Coal, Iron, Copper, Lead, Tin

—AND—

PRECIOUS STONES.

TITLES GIVEN DIRECT FROM THE CROWN, ROYALTIES AND RENTALS MODERATE.

GOLD AND SILVER.

Under the provisions of chap. 7, Revised Statutes of Mines and Minerals, Licenses are issued for prospecting Gold and Silver for a term of six months, which can be extended by renewal for another six months. Mines of Gold and Silver are laid off in areas of 150 by 250 feet, any number of which up to one hundred can be included in one License, provided that the length of the block does not exceed twice its width. Up to ten areas the cost is 50 cts. per area, for every area in addition in same application 25 cents. Cost of renewal one half the original fees. Leases of any number of areas are granted for a term of 21 years at $2-00 per area. These leases are forfeitable if not worked, but advantage can be taken of a recent Act by which on payment of 50 cents annually for each area contained in the lease it becomes non-forfeitable if the labor be not performed.

Licenses are issued to owners of quartz crushing mills who are required to pay Royalty on all the Gold they extract at the rate of two per cent. on smelted Gold valued at $19 an ounce, and in smelted gold valued at $18.00 an ounce.

Applications for Licenses or Leases are receivable at the office of the Commissioner of public Works and Mines each week day from 10 a.m. to 4 p.m., except Saturday, when the hours are from 10 to 1. Licenses are issued in the order of application according to priority. If a person discovers Gold in any part of the Province, he may stake out the boundaries of the areas he desires to obtain, and this gives him one week and twenty-four hours for every 15 miles from Halifax in which to make application at the Department for his ground.

MINES OTHER THAN GOLD AND SILVER.

Licenses to search for twelve months are issued, at a cost of twenty dollars, for minerals other than Gold and Silver, out of which one square mile can be selected for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

All rentals are refunded if afterwards the areas are worked and pay royalties. All titles, transfers, etc., of minerals are registered by the Mines Department free of charge, and provision is made for lessees and licensees whereby they can acquire promptly either by arrangement with the owner or by arbitration all land required for their mining works.

The Government as a security for the payment of royalties, makes the royalties first lien on the plant and fixtures of the mine.

The unusually generous conditions under which the Government of Nova Scotia grants its minerals have introduced many outside capitalists, who have always stated that the Mining laws of the Province were the best they had had experience of.

The royalties on the remaining minerals are: Copper, four cents on every unit; Lead, two cents upon every unit; Iron, five cents on every ton; Tin and Precious Stones; five per cent.; Coal, 7½ cents on every ton sold.

The Gold district of the Province extends along its entire Atlantic coast, and varies in width from 10 to 40 miles, and embraces an area of over three thousand miles, and is traversed by good roads and accessible at all points by water. Coal is known in the Counties of Cumberland, Colchester, Pictou and Antigonish, and at numerous points in the Island of Cape Breton. The ores of Iron, Copper, etc., are met at numerous points, and are being rapidly secured by miners and investors.

Copies of the Mining Law and any information can be had on application to

THE HON. C. E. CHURCH,

Commissioner Public Works and Mines,

HALIFAX, NOVA SCOTIA.

INTERCOLONIAL RAILWAY
OF CANADA.

The direct route between the West and all points on the Lower St. Lawrence and Baie des Chaleur, Province of Quebec; also for New Brunswick, Nova Scotia, Prince Edward and Cape Breton Islands, Newfoundland and St. Pierre.

EXPRESS TRAINS leave Montreal and Halifax daily (Sunday excepted) and run through without change between these points in 30 hours.

The Through Express Train cars of the Intercolonial Railway are brilliantly lighted by electricity and heated by steam from the locomotive, thus greatly increasing the comfort and safety of travellers.

New and Elegant Buffet Sleeping and Day Cars are run on all through Express Trains.

CANADIAN EUROPEAN MAIL AND PASSENGER ROUTE.

Passengers for Great Britain or the Continent by leaving Montreal on Friday morning will join Outward Mail Steamer at Halifax the same evening.

The attention of shippers is directed to the superior facilities offered by this route for the transport of flour and general merchandise intended for the Eastern Provinces and Newfoundland; also for shipments of grain and produce intended for the European market.

Tickets may be obtained and all information about the route, also Freight and Passenger rates, on application to

G. W. ROBINSON,
Eastern Freight and Passenger Agent,
136½ St. James Street, MONTREAL.

E. KING,
Ticket Agent,
27 Sparks Street, OTTAWA.

Railway Offices, Moncton, N.B., 14th November, 1889.

D. POTTINGER, Chief Superintendent.

MAP
—OF THE—
Phosphate Region
—OF—
OTTAWA COUNTY, QUEBEC.

PRICE, TWO DOLLARS.

On sale only at the Offices
OF THE
CANADIAN MINING REVIEW,
OTTAWA.

MINING REGULATIONS

TO GOVERN THE DISPOSAL OF DOMINION LANDS CONTAINING MINERALS, OTHER THAN COAL, 1890.

THESE REGULATIONS shall be applicable to all Dominion Lands containing gold, silver cinnabar, lead, tin, copper, petroleum, iron or other mineral deposits of economic value, with the exception of coal.

Any person may explore vacant Dominion Lands not appropriated or reserved by Government for other purposes, and may search therein either by surface or subterranean prospecting for mineral deposits, with a view to obtaining under the Regulations a mining location for the same but no mining location or mining claim shall be granted until the discovery of the vein, lode or deposit of mineral or metal within the limits of the location or claim.

QUARTZ MINING.

A location for mining, except for iron or petroleum, on veins, lodes or ledges of quartz or other rock in place, shall not exceed 1,500 ft. in length and 500 ft. in breadth. Its surface boundary shall be four straight lines, the opposite sides of which shall be parallel, except where prior locations would prevent, in which case it may be of such a shape as may be approved of by the Superintendent of Mining.

Any person having discovered a mineral deposit may obtain a mining location therefor, in the manner set forth in the Regulations which provides for the character of the survey and the marks necessary to designate the location on the ground.

When the location has been marked conformably to the requirements of the Regulations, the claimant shall within sixty days thereafter, file with the local agent in the Dominion Land Office for the district in which the location is situated, a declaration or oath setting forth the circumstances of his discovery, and describing, as nearly as may be, the locality and dimensions of the claim marked out by him as aforesaid; and shall, along with such declaration, pay to the said agent an entry fee of FIVE DOLLARS. The agent's receipt for such fee will be the the claimant's authority to enter into possession of the location applied for.

At any time before the expiration of FIVE years from the date of his obtaining the agent's receipt it shall be open to the claimant to purchase the location on filing with the local agent proof that he has expended not less than FIVE HUNDRED DOLLARS in actual mining operations on the same; but the claimant is required, before the expiration of each of the five years, to prove that he has performed not less than ONE HUNDRED DOLLARS' worth of labour during the year in the actual development of his claim, and at the same time obtain a renewal of his location receipt, for which he is required to pay a fee of FIVE DOLLARS.

The price to be paid for a mining location shall be at the rate of FIVE DOLLARS PER ACRE, cash, the sum of FIFTY DOLLARS extra for the survey of the same.

No more than one mining location shall be granted to any individual claimant upon the same lode or vein.

IRON AND PETROLEUM.

The Minister of the Interior may grant a location for the mining of iron or petroleum, not exceeding 160 acres in area which shall be bounded by north and south and east and west lines astronomically, and its breadth shall equal it in length. Provided that should any person making an application purporting to be for the purpose of mining iron or petroleum thus obtain, whether in good faith or fraudulently, possession of a valuable mineral deposit other than iron or petroleum, his right in such deposit shall be restricted to the area prescribed by the Regulations for other minerals, and the rest of the location shall revert to the Crown for such disposition as the Minister may direct.

The regulations also provide for the manner in which stone quarries may be acquired.

PLACER MINING.

The Regulations laid down in respect to quartz mining shall be applicable to placer mining as far as they relate to entries, entry fees, assignments, marking of localities, agents' receipts, and generally where they can be applied.

The nature and size of placer mining claims are provided for in the Regulations, including bar, dry, bench, creek or hill diggings, and the RIGHTS AND DUTIES OF MINERS are fully set forth.

The Regulations apply also to

BED-ROCK FLUMES, DRAINAGE OF MINES AND DITCHES.

The GENERAL PROVISIONS of the Regulations include the interpretation of expressions used therein; how disputes shall be heard and adjudicated upon; under what circumstances miners shall be entitled to absent themselves from their locations or diggings, etc., etc.

THE SCHEDULE OF MINING REGULATIONS

Contains the *forms* to be observed in the drawing up of all documents such as:—"Application and affidavit of discoverer of quartz mine." "Receipt for fee paid by applicant for mining location." "Receipt for fee on extension of time for purchase of a mining location." "Patent of a mining location." "Certificate of the assignment of a mining location." "Application for grant for placer mining and affidavit of applicant." "Grant for placer mining." "Certificate of the assignment of a placer mining claim." "Grant to a bed-rock flume company." "Grant for drainage." "Grant of right to divert water and construct ditches."

Since the publication, in 1884, of the Mining Regulations to govern the disposal of Dominion Mineral Lands the same have been carefully and thoroughly revised with a view to ensure ample protection to the public interests, and at the same time to encourage the prospector and miner in order that the mineral resources may be made valuable by development.

COPIES OF THE REGULATIONS MAY BE OBTAINED UPON APPLICATION TO THE DEPARTMENT OF THE INTERIOR.

A. M. BURGESS,
Deputy Minister of the Interior.

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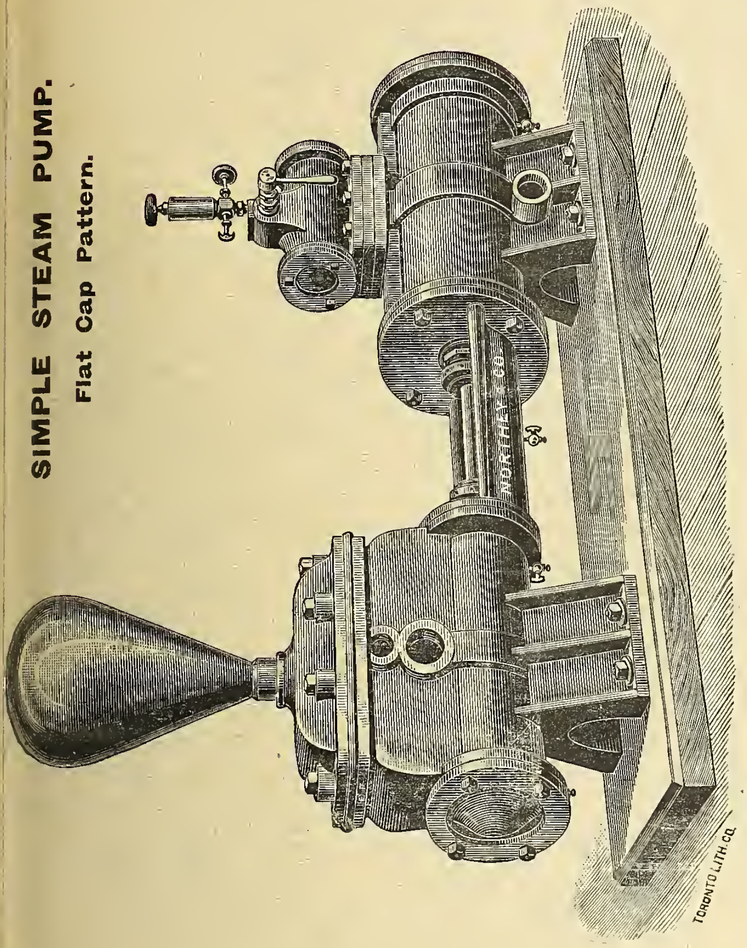
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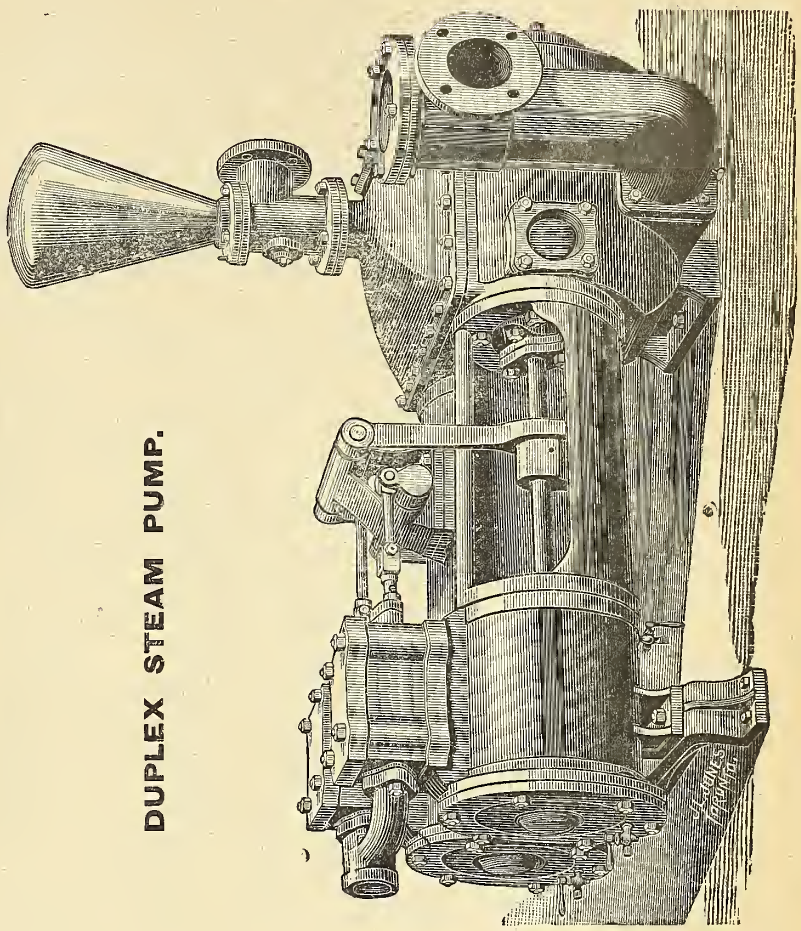

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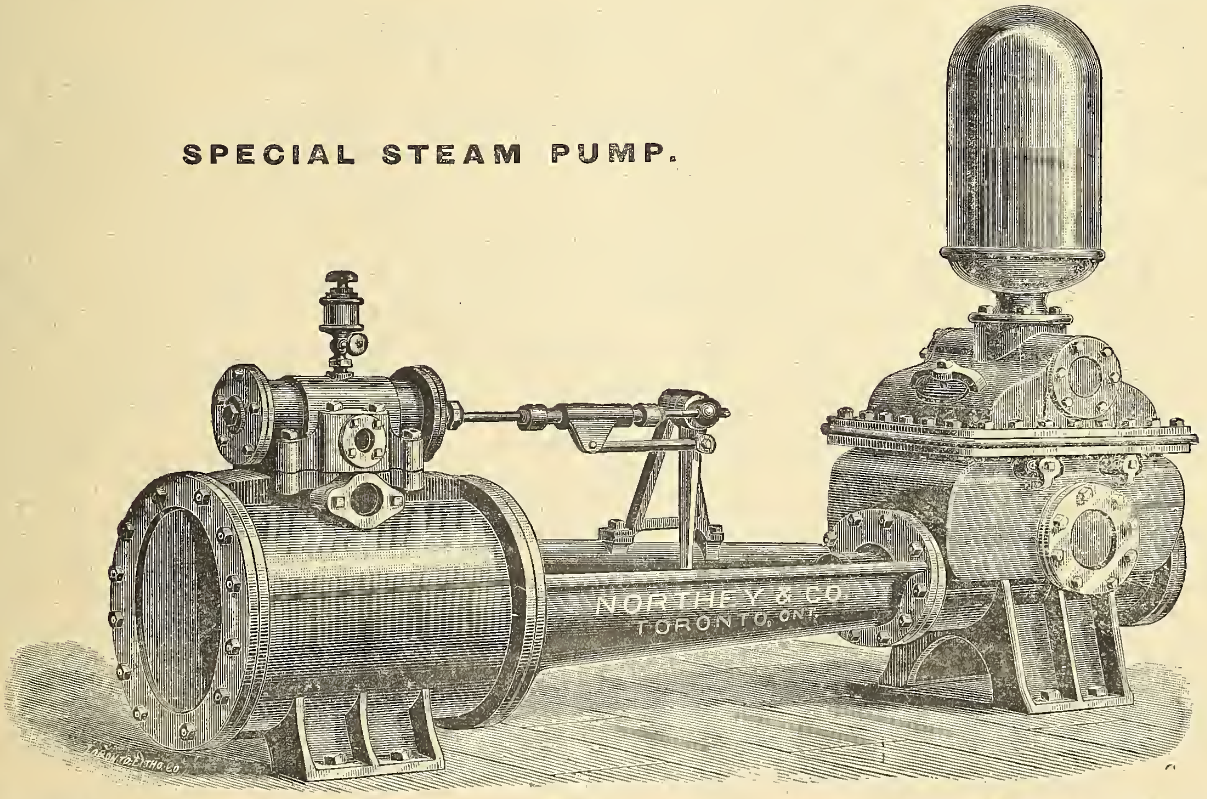
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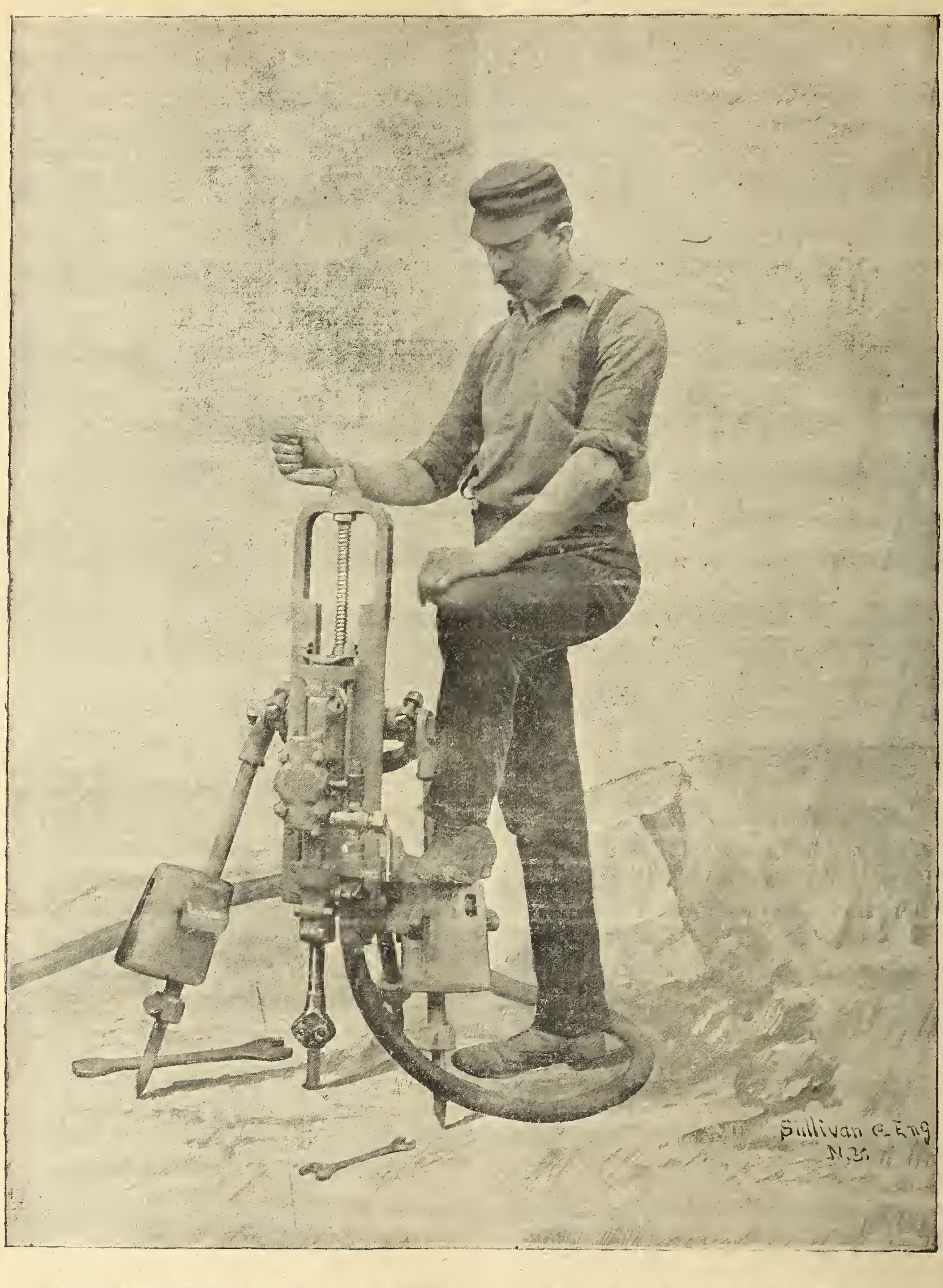

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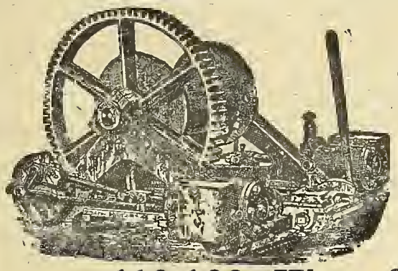

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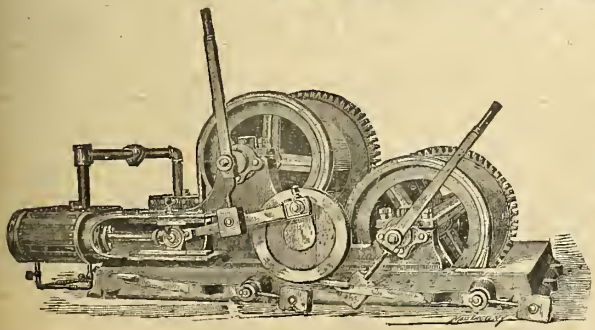

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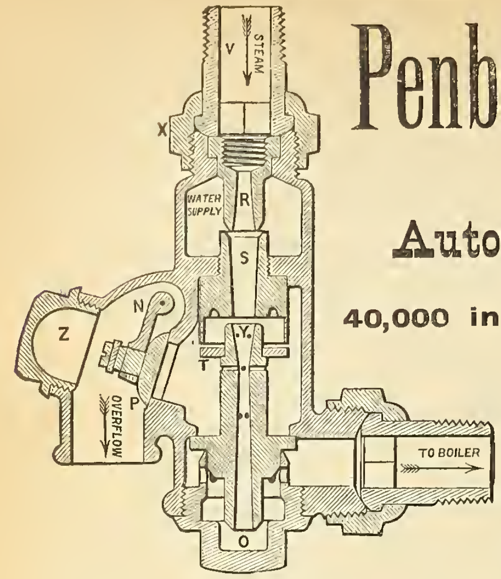

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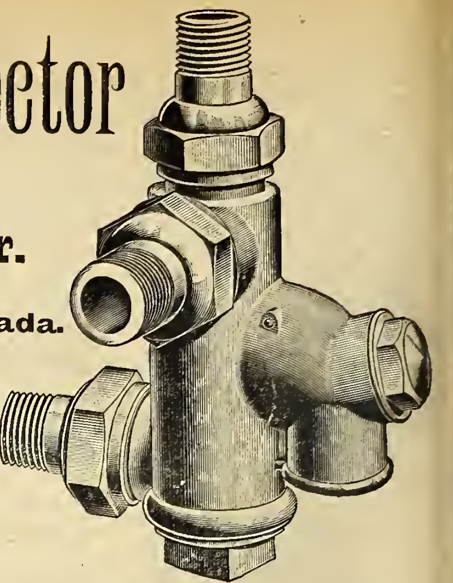

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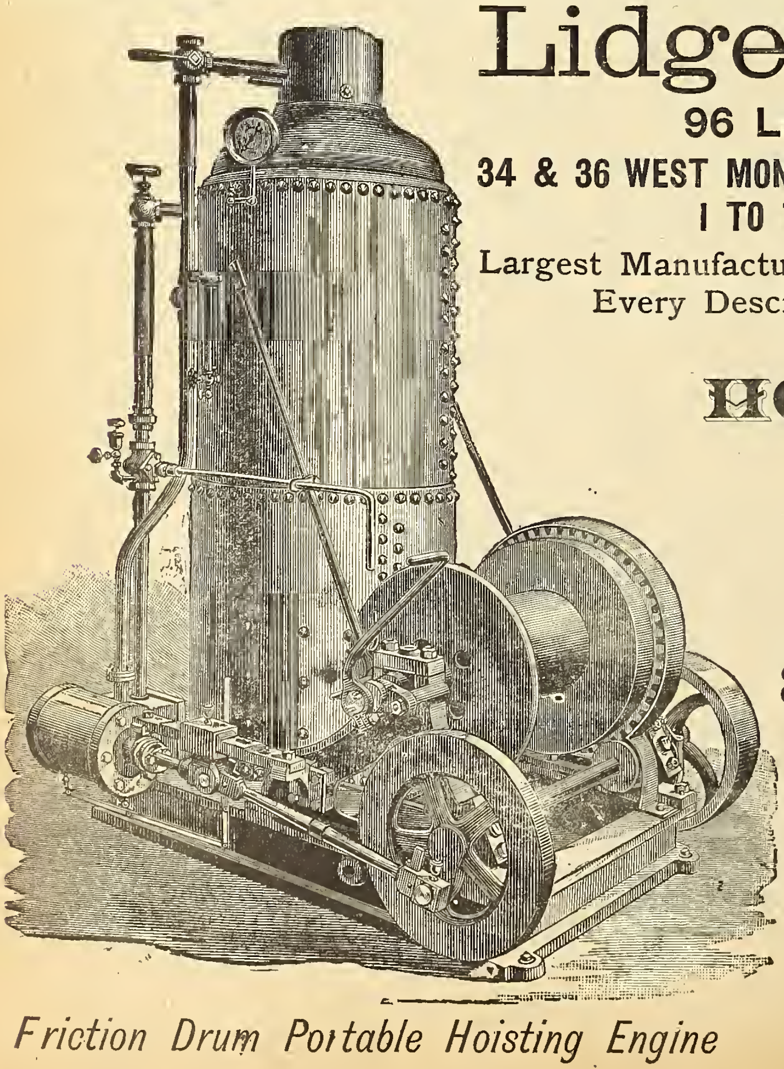

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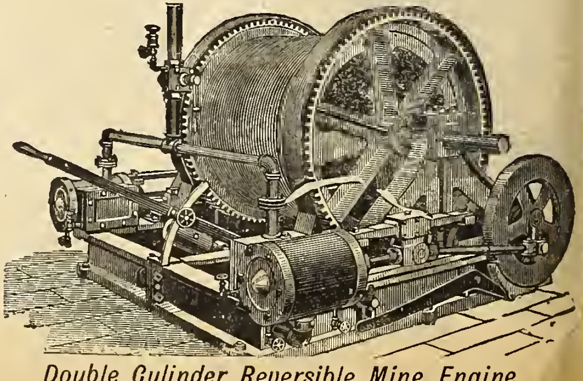

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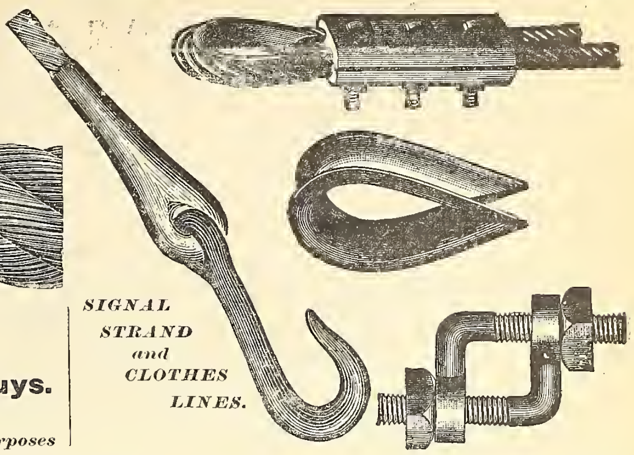

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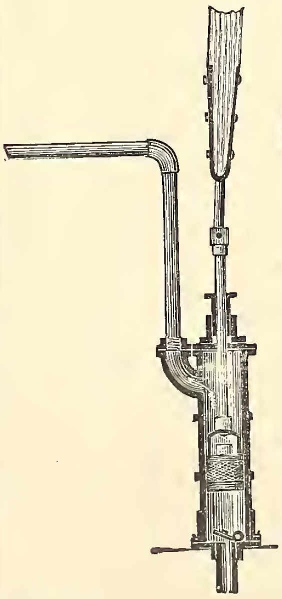

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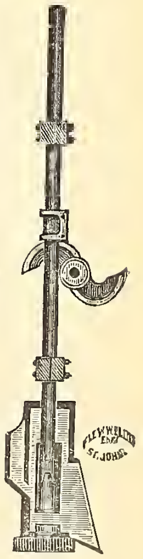

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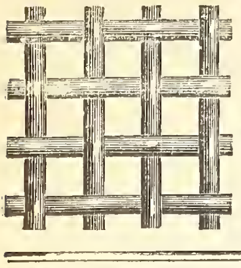

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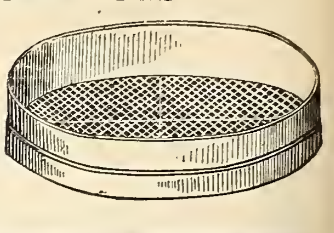

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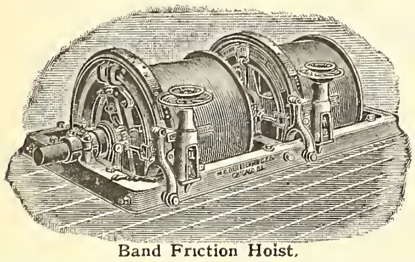

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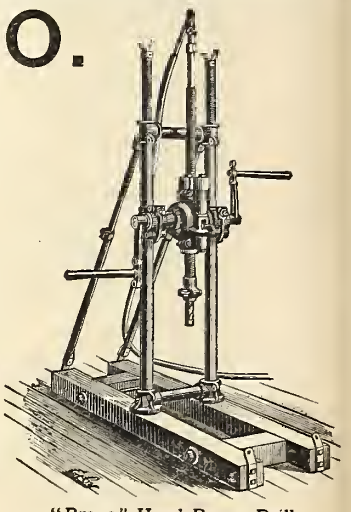

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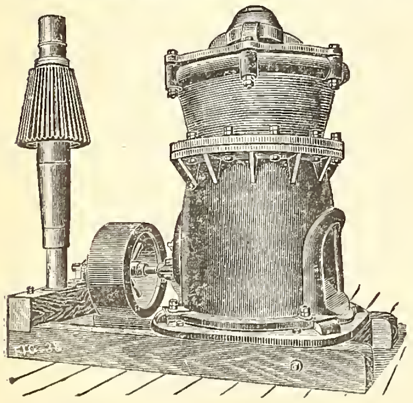

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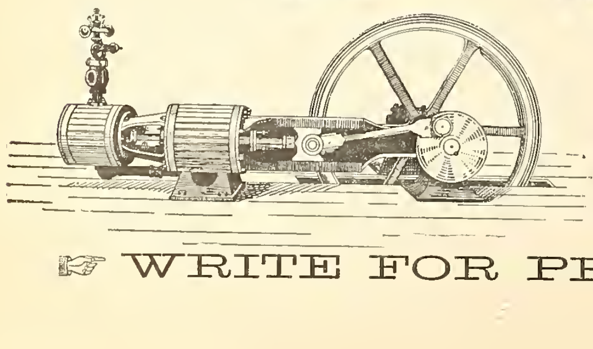

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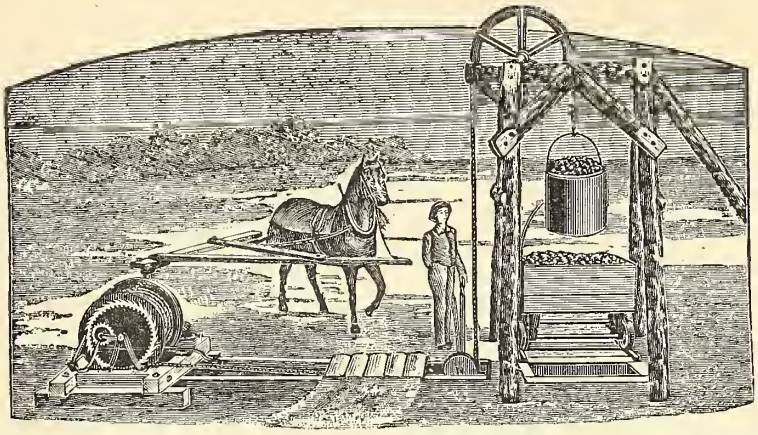

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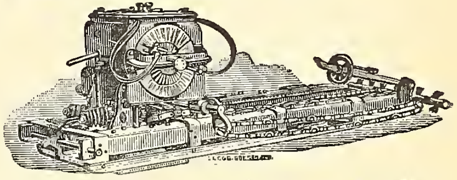

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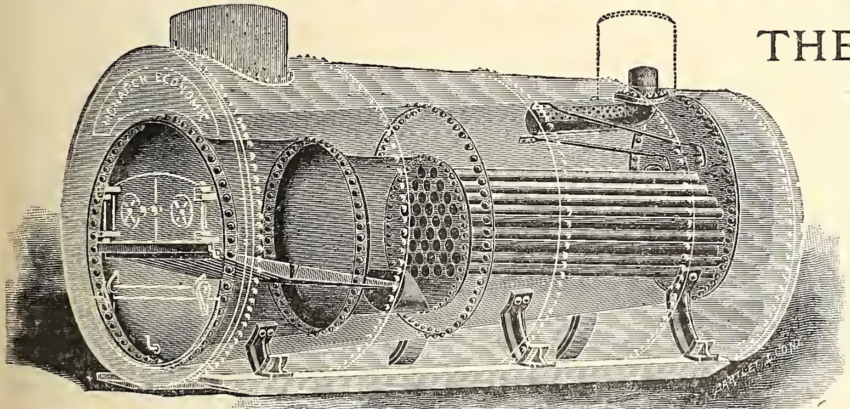

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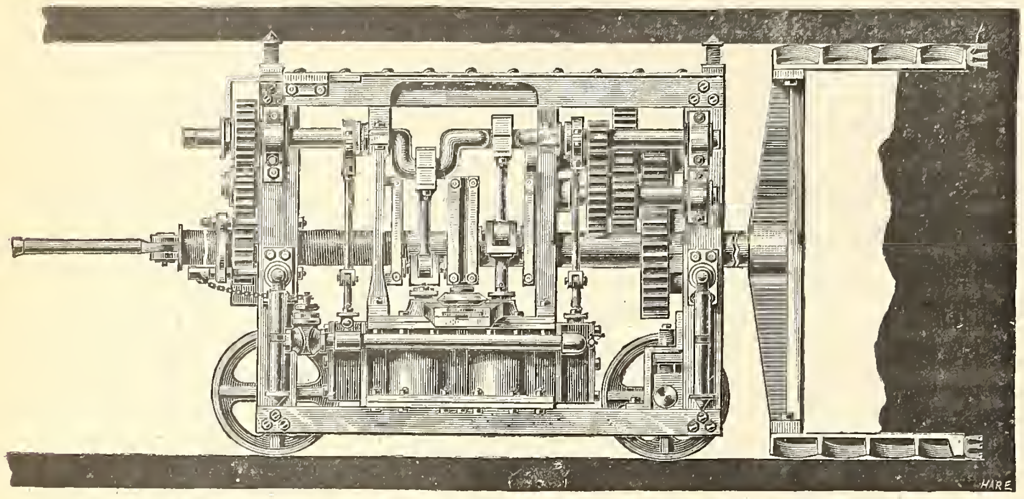

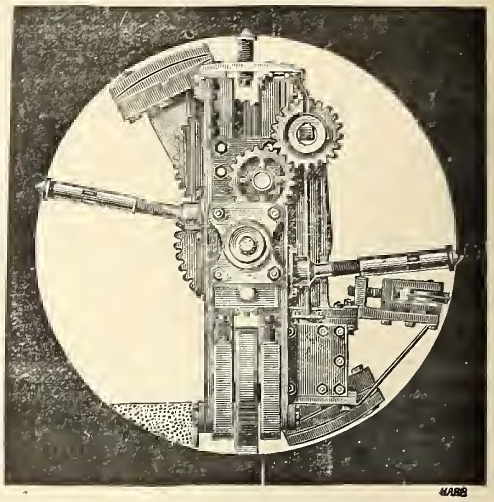

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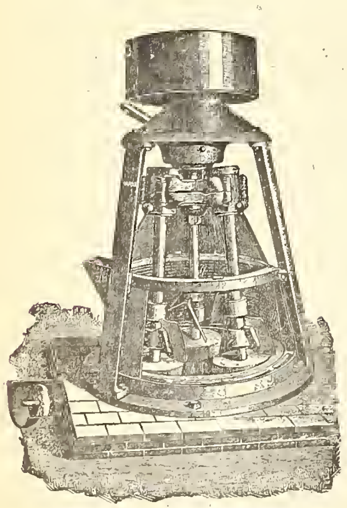

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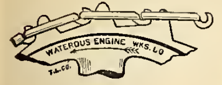

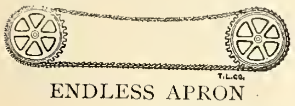

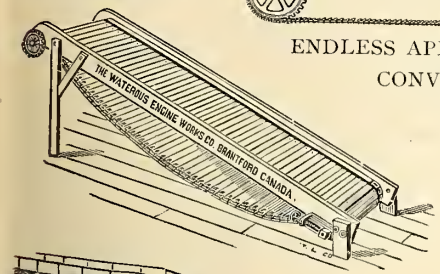
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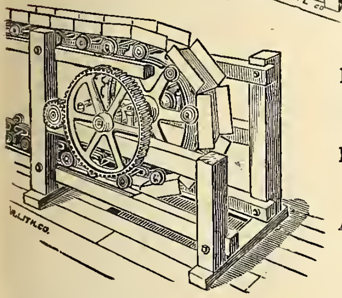

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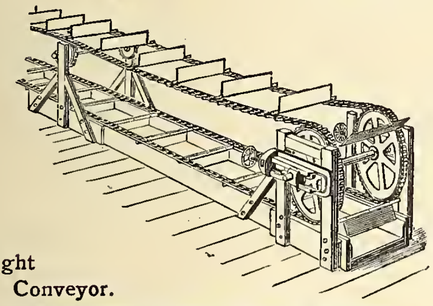

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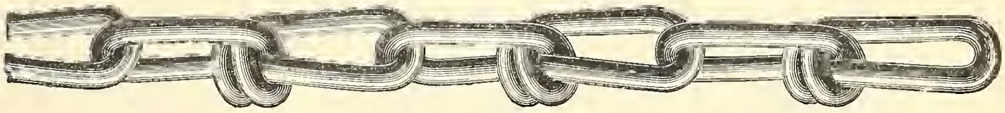

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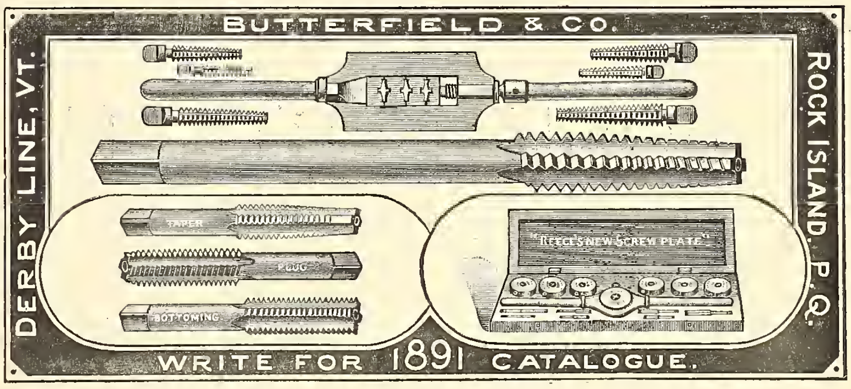

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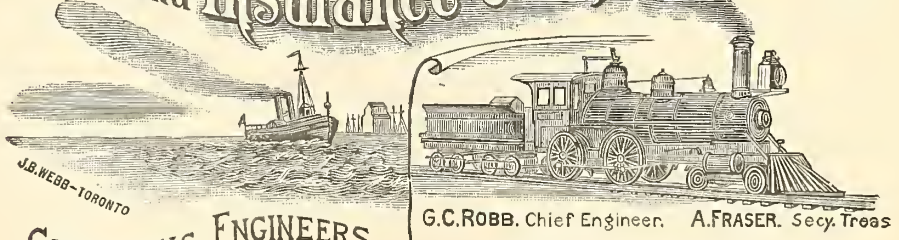

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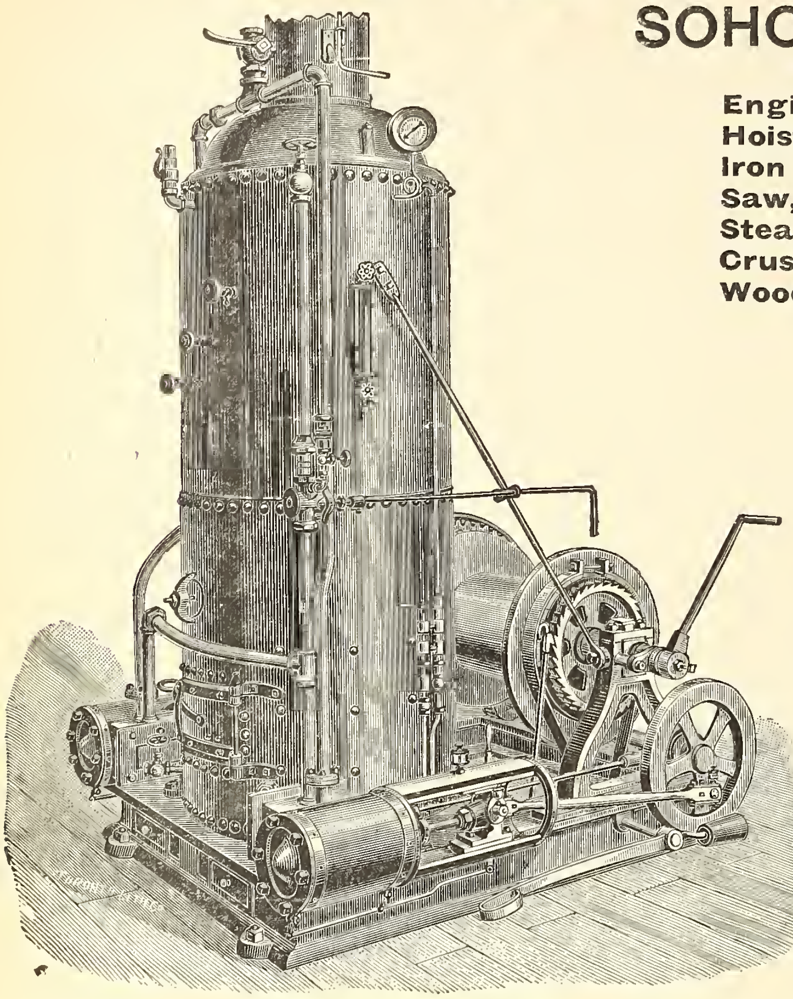

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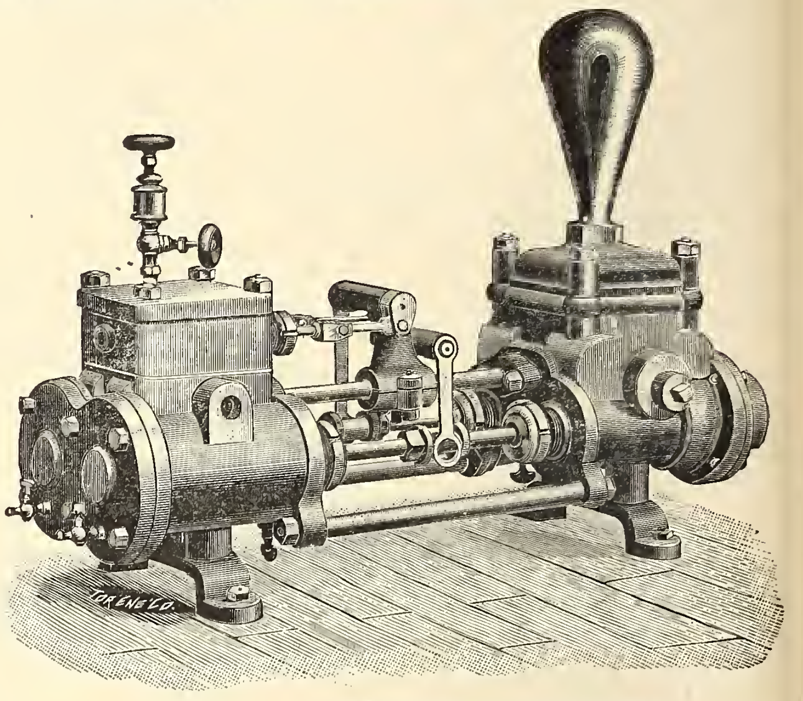

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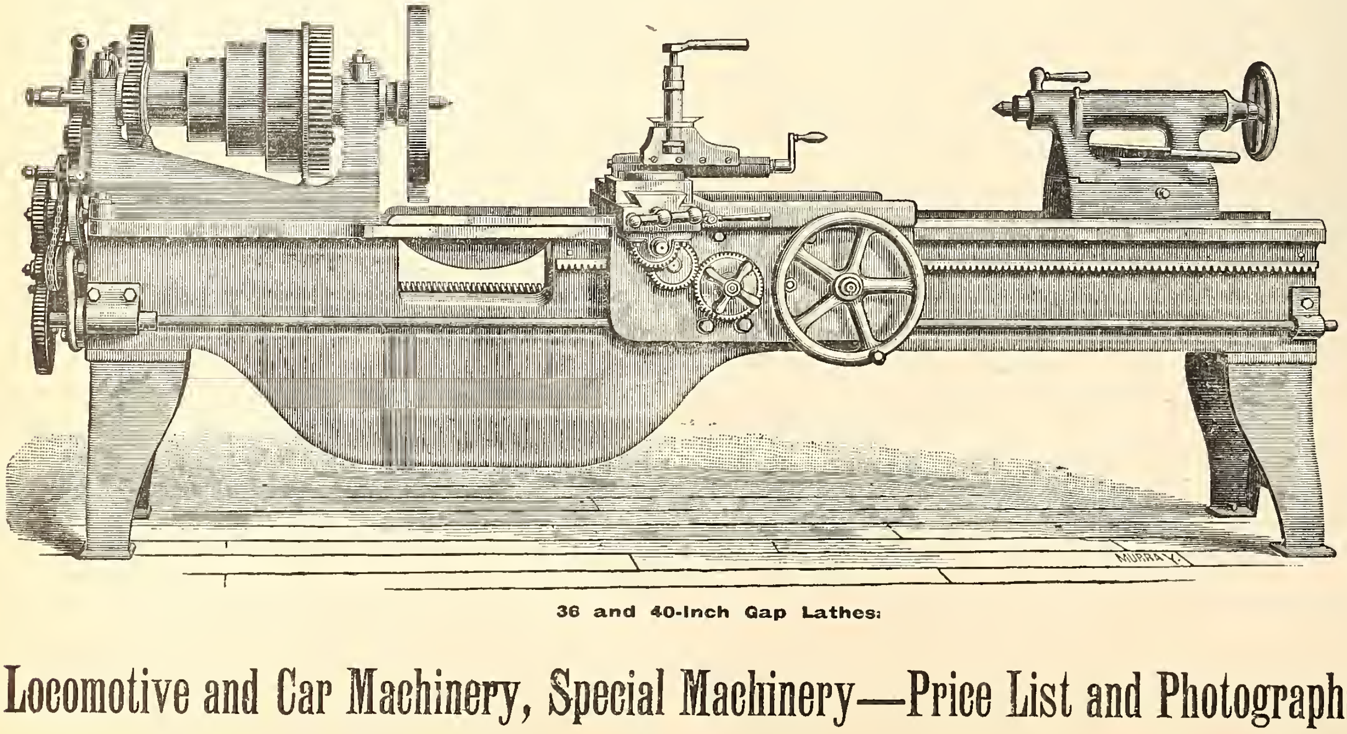

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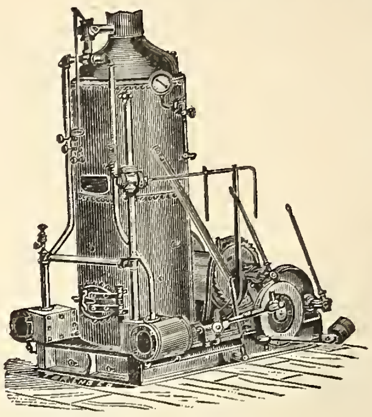

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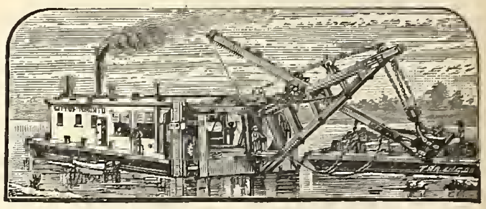

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Vol. X. MAY, 1891. No. 5.

Mining Legislation in Nova Scotia.

There are many people who believe that every evil under the sun can be cured by legislation, and carry their ideas so far that superfluous nursing results in an overgrown and useless bantling. The various well-meant attempts at temperance legislation afford the best example of the futility of trying to make people good or wise by act of parliament. Proportionally speaking, more accidents happen from falling into the water, runaway horses, and fire-arms, than from the explosions of mines, railway accidents, etc., but no legislator has yet introduced a bill to forbid persons unable to swim from going near the water, nor must any one have a certificate before he is allowed to drive a horse.

The isolated accidents continually happening to individuals, and daily recorded in the newspapers, attract but a fleeting attention, while the mind is aroused, and public interest excited by the contemplation of a catastrophe overwhelming a number of our fellow beings. It is to this feeling of public opinion, which is so promptly and energetically expressed whenever a community is startled and saddened by an unusual fatality, that we owe the most valuable and effective legislation for the safety of the community.

The calling of the miner, in all circumstances one of peril, has specially enlisted the public interest, since the sympathy of the philanthropic Earl of Shaftesbury initiated the first practical legislation ameliorating his condition. In the Province of Nova Scotia, the explosion at the Drummond Colliery, in 1873 accentuated the necessity of a Mines Regulation Act. The explosion at the Foord pit, causing the loss of some forty-five lives, led to additional inspection, the inauguration of a system of certificates for the under managers and overmen, greater facilities for conducting inquests, and fuller recognition of the rights of workmen to present their views at any investigations, etc. Some of these improvements were adopted in the English Mines Regulation Act of 1877, and this imitation reflects credit on the Grand Council of the Miners' Union in Nova Scotia, a body who have been ably represented by their secretary, lately appointed to the Legislative Council, the Hon. Robert Drummond. The recent explosion at Springhill, which happened in a colliery admittedly one of the best managed in the Province, excited much interest and sympathy. The coroner's inquest, before a jury composed principally of practical miners, showed that the management had done the best they could; they had spent large sums in improving the ventilation; the use of powder had been discontinued in the section of the mine which formed the immediate seat of the explosion; the dust was damped by water; and powder was used only a few times a week, to blow down stone enough to allow the tubs to pass. The requirements of the law appeared to have been complied with, and no want of care was shown. When the evidence was summed up it appeared that a shot fired in this stone had ignited gas and dust and caused the explosion.

A series of amendments, some of which had been in contemplation for some time, were introduced into the Provincial Legislature. The managers of the collieries, and representatives of the principal lodges, were heard before the Committee of the Legislative Council. Among the most notable changes were the following: The earliest age at which boys were to work about mines was raised from ten to twelve years, and hereafter any boy on seeking employment at a mine must produce a certificate of his being able to write and that he has an elementary knowledge of arithmetic. All persons hereafter, on seeking employment as engine drivers, etc., must be holders of certificates granted by an examiner to be appointed by the government.

Hitherto the use of gunpowder within twelve months after gas had been found in a mine was permitted only under the direction of a man specially appointed for the purpose of firing shots, and when gas issued so freely as to show a blue cap on the flame of the safety lamp it would be generally used only when the workmen were out of the mine. Under the proposed legislation whenever gas has been detected on any three consecutive days in a mine, the use of any explosive is prohibited except when the men are out of the pit. This practically excludes the use of explosives in the most gaseous mines of the Province. An additional clause says that under certain circumstances, if a mine be damp and not dry, the use of explosives may be allowed until gas is found on any two consecutive days in any two consecutive weeks. The discussion over the legislation thus briefly outlined, was interesting. The question of the use of roburite, and of nitro-glycerine compounds with nitrate of ammonia, was discussed, but the general opinion expressed seemed to be of doubt as to the propriety of legislation stamping any of them with the full mark of safety. It may be said, perhaps, that so far as the blasting of coal is concerned, if the danger of gunpowder be admitted, then it is as well to let the coal be got by wedging as to incur the greater cost of a patent explosive, the absolute safety of which cannot be guaranteed. The opinion was advanced and received with favor that the Government should appoint a small committee to collect the latest and most authentic information on the subject of the explosives that could replace gunpowder in the presence of inflammable gas. The most practical attempt made in this direction appears to be that of the French Government, which declares by its inspection a mine to be gaseous, and prohibits therein the use of any explosive which at the moment of its detonation, reaches a temperature exceeding 1500° Centigrade. There appear to be several compounds fairly coming under this head, but it is at present a question how far their cost would permit of their use in Nova Scotia. The advances lately made toward the composition of a flameless explosive are promising, and it is to be hoped that before long one may be found that can exert its disruptive power in the presence of the most ignitable substances. Amendments were also introduced to facilitate the settlement of disputes as to the deductions to be made from the coal on account of any impurities left in it by the miners. Another important amendment referred to the classification of coal miners. Hitherto men who claimed to be competent coal-cutters were necessarily hired on their own representations, but after the close of the present year, all must be holders, either of certificates that they have cut coal long enough to show their capability, or be holders of certificates based on examination. There is no doubt that wherever coal is mined under conditions of danger, such as the presence of gas, drawing of pillars, only cutters of experience should be employed, and this regulation by putting the working faces directly in the charge of steady men should work well for masters and employed.

These are the most striking innovations of the legislation sought this year, and it is to be hoped that they will help to reduce the many accidents that are recorded. If it were possible in any way to legislate the miners in the Nova Scotia gold mines into a habit of handling dynamite with more care, it would be a blessing. Already this year the newspapers report two serious accidents, both apparently due to gross want of the ordinary precautions. In both cases property was destroyed, and in one instance several men were seriously injured. A Bill was also introduced compellng all coal companies to pay their men fortnightly; this is now the practice at several mines, and can be easily carried out.

In concluding these remarks on the amendments to the Mines Regulation Act, it may be said that the most important is that limiting the use of explosives. There is no doubt that before long gunpowder will be an explosive of the past wherever gas is met. Mining experience teaches that when a mine gives off gas, and powder is used, it is only a question of time when the two will unite with disastrous results. All possible care, and the most lavish expenditure on the part of the owner, may at any moment be nullified by the inattention of a subordinate official, or the carelessness of a miner, and a mine may be likened to a chain, with the weakest link replaced by the most inefficient person employed therein. The only other district in the Dominion in which coal is mined to any extent is British Columbia. It would be well for the Government and coal operators of that Province to take to heart the lesson learned in Nova Scotia, and without waiting for the bitterness of personal experience, to recognize that prevention is best for safety of life, when there is no remedy after an accident.

Ontario's New Mining Laws.

The mining laws of the Province of Ontario were amended in some important particulars during the Session which ended on the 5th instant. Three measures were introduced at an early period of the Session, one of which provided for the staking out of mining claims, another for the reserving of minerals in all future sales of public or agricultural lands, and a third for amending in some particulars the general Mining Act.

The first of these Bills appears to have been carefully framed, and had it become law, we are disposed to think that it would have been gladly accepted by the class whose interests it was intended to serve, viz.: the mining prospectors. In some respects, perhaps, it should have gone more largely into detail, and we think also that the working conditions were out of proportion to those required of persons who might acquire locations in another way. But these are matters which could have been worked out in committee, and was it not for the general anxiety of the Legislature to bring its labors to a close, owing to the lateness of the Session, the Bill could no doubt have been framed into a law. The Commissioner of Crown Lands has, however, had the benefit of a free discussion of its provisions, and he will, it may be assumed, have less hesitancy in dealing with it more vigorously next year.

The Act which amends the Public Lands Act is a veritable "looking backward," for it returns to the policy which prevailed in the olden time in the Province of Ontario with respect to the Crown's interest in patented lands. It provides that in any letters patent for lands hereafter granted for agricultural purposes all mines, minerals and mining rights are reserved to the Crown, unless otherwise provided in the patent, and are a property separate from the soil. The Act declares that they shall "continue to be the property of the Crown and be public property, independent from that of the soil above it," unless the proprietor of the soil had acquired it from the Crown as a mining location or otherwise. It will be remembered that previous to the Act of 1869, all ores of gold and silver in lands patented in Ontario were reserved to the Crown in the grant; but by that Act all such rights or claims on the part of the Crown were abandoned. The present Act proposes that henceforth the Crown shall part with its surface rights only, reserving to itself every other ore and mineral as well as gold and silver. We do not notice that any provision is made for the sale of the property so reserved to any other party, nor to the right of such party to go upon the land and sink shafts or otherwise explore for minerals or operate the mines; and this looks like an important omission. It does not, however, appear to be the intention to apply this provision of the Public Lands Act generally, for it is provided that the Governor-in-Council may by order set apart any tract of the Province not being mineral lands, in respect of which the grants or patents shall expressly vest in the grantee the minerals and mining rights, or such of them as may be specifically mentioned in the order or patent. Of course, it will be understood that the reservation applies to future sales under the statute, and is in no sense retroactive.

The amendments to the General Mining Act deal with five different subjects, viz.: the prices of mining locations; conditions of occupation; royalties upon ores or minerals payable to the Crown; leasehold tenure of mining lands, and the establishment of a Bureau of Mines.

The Act of 1869 underwent but one alteration from that year to the present, and that consisted in raising the price of mining locations from $1 to $2 per acre. The activity in mining operations during the past two or three years, and notably the boom created by the discovery of great bodies of nickel ore in the country north of Georgian Bay, appears to have convinced the Government that an increase in price could be borne by the parties anxious to invest in mining lands, and that a step in this direction was desirable in the public interest. Accordingly, we find that the new Act makes a very substantial advance in selling prices; but, unlike the former provision, the figures are graduated on a basis of assumed values. Thus, in the whole of that part of the Province above the French and Mattawa rivers and Lake Nipissing, in the districts of Nipissing, Algoma, Thunder Bay and Rainy River, the prices of mining lands or locations are fixed as follows:

If within a surveyed township and within 12 miles of any railway............	$4 50	per acre.
If within 12 miles of any railway, but in unsurveyed territory.....	4 00	do
All other mining lands in surveyed territory...........................	3 50	do
All other mining lands in unsurveyed territory...........................	3 00	do

As regards all Crown lands sold as mining lands or locations, and lying south of the French and Mattawa rivers and Lake Nipissing, the following prices are fixed:—

If within a surveyed township, any part of which lies within 12 miles of any railway.........	$3	per acre.
If situate elsewhere.............	2	per acre.

But it is provided that where any locality is shown to be rich in minerals, the Governor-in-Council may set apart the whole or any part of it, and fix the price per acre at any greater sum as above specified, or may temporarily withdraw it from sale altogether.

Some consideration, however, is shown to parties who had been prospecting for minerals, or who had paid money on locations before the withdrawal of lands in the Sudbury district from sale last year; for it is provided that in certain cases, such parties may acquire grants of farming lands at the old prices and subject to the old conditions.

But the person who desires to obtain a mining location is not obliged to purchase it at the foregoing figures; he may, if he see fit, acquire the right to hold and work the property under a lease for ten years, instead of a tenure in fee simple, with right of renewal for a further term of ten years at the same rental if the covenants and conditions have been performed. The rental is $1 per acre for the first year, and twenty-five cents an acre per annum thereafter, for lands above Lake Nipissing and the French and Mattawa rivers, and sixty cents an acre the first year and fifteen cents an acre per annum thereafter for lands situated elsewhere—the rental in all cases to be payable yearly in advance. It is further provided, that at the end of the second term of ten years, if the covenants and conditions have been fulfilled, the lease may be renewed for a term of twenty years on such conditions and at such rent as the regulations shall provide, and so on from time to time at the expiration of every twenty years. It is also provided that the lessee may become the purchaser of the land, if he has complied with the conditions, in which case the sum paid for the first year's rental is to be treated as part of the purchase money; that the lease may be forfeited if default is made in payment of rent; and that in case of forfeiture or non-renewal of the lease the lessee may remove any mining plant and machinery which he may have placed upon the premises, if so agreed upon in the lease.

As regards conditions of occupation it is provided that, whether the land is held in fee simple or under lease, the occupier shall expend in stripping or in opening up the mines, in sinking shafts or in other actual mining operations, at the rate of $4 per acre during the first seven years where the location exceeds 160 acres, and $5 per acre where it is less. In default of such expenditure the tenure is to become absolutely forfeited in the case of a leasehold, and in the case of the grantee or owner the mineral right is to revert to the Crown, saving only his interests in the soil as agricultural land, distinct from the minerals.

The provision respecting royalties applies alike to occupation in fee simple and leasehold, but only as regards ores or minerals taken from lands sold, granted or leased by the Crown under the amended Act. The royalties are to be calculated upon the value of the ores at the pit's mouth, and are fixed as follows, viz.: Silver, nickel or nickel and copper, 3 per cent.; all other ores except iron are to be subject to such royalty, not exceeding 3 per cent., as may be imposed from time to time by Order in Council, and iron ore not exceeding 2 per cent. But "to assure speedy development," it is provided that the royalty thus reserved is not to be imposed or collected upon any ores until after seven years from the date of the patent or lease, except as to mines known to be rich in nickel, and as to those not until after four years. It is reasonable to assume that the lawmakers of Ontario are desirous of promoting a speedy development of the mineral resources of the Province. One can hardly suppose that there is a member of the Legislature on either side of the Chamber, no matter whether out of or in the Cabinet, who favors a policy of tardy development of the industry. Yet the very language of the statute implies that the royalties are calculated to hinder development; for it is specifically declared that the object of postponing their operation is "to assure the speedy development." This, indeed, is a *rara avis* in the phraseology of an Act of Parliament.

The only remaining subject dealt with in this Act is a Bureau of Mines, established in connection with the Department of Crown Lands, and with the object of promoting the mining interests of the Province. The head of the Bureau is to be known as "Director of the Bureau of Mines," and it is provided that he is to have all the powers, rights and authority which an inspector or local agent has or may exercise in any mining division or locality, and such other powers, rights and authority for the carrying out of the provisions of the Act as may be assigned to him by regulation for that purpose. In a word, he has scope enough for the doing of useful work, and we are confident that in Mr. A. Blue the government has found a Director possessing the ability and the energy to undertake it and do it.

EN PASSANT.

The subject of our next portrait sketch will be Mr. John Rutherford, Stellarton, the first Inspector of Mines for the Province of Nova Scotia, and one of the most widely known and respected mining men of that province.

According to the Annual Report of the Department of the Interior, for 1890, just issued, twenty entries were made during the year for mining locations other than coal. The revenue received was $621, of which amount the sum of $181 was received in payment of fees for entry and for registration of assignments. The total area of mining locations sold up to date is 1,152.56 acres, for which $5,846.50 has been realized. Some 170 applications for petroleum locations in the District of Alberta were filed, but as the applicants could not furnish affidavits in accordance with the mining regulations, that they had discovered petroleum in the lands applied for, entry could not then be granted to them. Subsequently, the regulations were amended to permit of their holding the lands upon making an affidavit, and this has been done in most cases.

There were 107 applications for coal mining lands during the year; eleven of the applicants were given the privilege of purchasing within a specified time the location for which they applied, and 18 were given permission to prospect. Five bought the land applied for, and one, being a homesteader, was permitted to mine coal by paying a royalty of five per cent. The revenue derived from the sale of coal lands in 1890 was $8,898.75, being an increase of $7,236.25 over the preceding year. The total area of coal lands sold up to date is 13,079.76 acres, and the total amount received therefor, $135,070.07.

Several important modifications of the Ontario Mining Bill have been secured by its opponents in the Legislature. The proposed prices of mining locations have been reduced, and above all, there has been a great change wrought in the royalty clause. No royalty will be imposed on iron, while other minerals will not be taxed until after seven years has elapsed from the date of the patent or lease. Those adverse to the Bill are by no means satisfied yet, but some of its most objectionable features have been modified by these concessions.

The increase in the production of granite in the United States has been very marked, having more than doubled in the last ten years. A bulletin on the subject prepared by Dr. William C. Day, under the supervision of Dr. David T. Day, has been issued by the United States Census Office, from which it is learned that the total value of the output in 1889 was $14,464,095, as compared with $5,188,998 in 1880, a gain of $9,275,097 or 179 per cent. in the decade. This represents 62,287,156 cubic feet of granite, produced by 22,313 workmen from 874 quarries, to whom $9,620,485 were paid in wages. The total expenditure was $11,504,021, thus showing a profit of $2,960,074 on an invested capital of $19,115,449. The uses to which granite is put are manifold, and too well known to need enumeration, but that which consumes most material is street paving, for which it is steadily growing in favor. Like all other productions of the Department, this bulletin contains a great deal of other information.

In an article on "Summer Schools of Science," the *Educational News* of St. John, N.B., makes the following pertinent remarks on the geological maps of Nova Scotia, so often referred to in these columns: "The only regret on this point is, that the minutely accurate geological maps of the county, completed by the survey two or three years ago, owing to the peculiar judgment and temper of the deputy head at Ottawa, had not yet been published, and are only proposed to be published on a surface sixteen times smaller than the maps of all the Cape Breton counties. A deputy has in such details, it appears, obstructive powers which even cabinet ministers may find it ticklish to deal with. We only stop to say that this and other points may soon be so clearly put to our people that the government may find no difficulty in dealing with the matter." Surely these continued representations must have some weight with the director, and some day the wishes of the people of the Lower Provinces will be gratified. But from present indications, the question seems to have been given the five years' hoist.

The preliminary estimate of the mineral production of Canada in 1890 has been issued by the Division of Mineral Statistics and Mines, under the direction of the Geological Survey. On the whole, the production last year was somewhat less than in 1889, the respective aggregate values being $19,500,000 in the latter, and $19,000,000 in the former year. Of the precious metals, 65,014 oz. of gold worth $1,166,227 were extracted in 1890, a decrease of 7,314 oz., or $128,932; and 400,687 oz. of silver valued at $420,662, an increase of 17,369 oz., or $76,814. During the year 3,117,661 tons of coal were won, as against 2,719,478 tons in 1889, the estimated value of the respective outputs being $6,396,910 and $5,584,182—an increase of 398,183 tons and $812,728. The output of phosphate is reported at 31,753 tons, 765 tons more than in 1889, representing $361,045, or an increase of $44,383. The price of copper advanced materially in 1890, or rather had rallied from the previous year's depression, caused by the failure of the French syndicate, and thus, although the production declined 344,839 lbs. to 6,454,913 lbs., its value at an estimate of 15c. per lb., was $968,241, as compared with $885,424 in 1889. Eight thousand tons of asbestos, worth $1,039,661, were mined in 1890, and 6,113 tons, representing $426,554 in the preceding year. The nickel contents of the matte shipped at Sudbury are estimated at 1,336,627 lbs., worth $1,002,470. Of pig iron, 21,772 tons were made in the Dominion, valued at $331,668, a decrease of 4,149 tons and $168,184. The production of iron ore enlarged, on the contrary, by 3,280 tons, being 76,511 tons in 1890, though as the returns for 1889 were not complete, the disparity was probably somewhat less. The exports of crude and cut mica in 1889 were valued at $28,718; in 1890 the production was worth $68,074. The other minerals with some variations present about the same figures as the previous year. It may be observed, however, that the estimated value of several of the above mentioned products seems to be somewhat wide of the mark. A closer attention to commercial quotations will ensure greater accuracy.

In another portion of this issue our readers will find a very full report of the first Quarterly General Meeting and dinner of the General Mining Association of the Province of Quebec. That both were an unqualified success every one present will admit. The discussions on the papers presented were unusually interesting and will exercise an influence for good in the community.

Although still in the swaddling clothes of early infancy, the Association is strong in membership, and is already exerting an influence which is felt beyond the confines of the province. The *Financial News*, (London, Eng.), has the following comment on the Montreal meeting: "A considerable sensation was caused in the Convention by the introduction of a petition by the Council, recording objections to recent legislation imposing an 'iniquitous' tax upon mines. Although a majority of the Liberals have resolved to petition the Governor-General to veto the Act, *much uneasiness has been caused by the resolution of the Council of the Association, as that institution wields great influence in the provinces, and if it be used against the Government it will prove a very serious obstacle.*"

Our readers will be interested in noting the objections to the Act as embodied in the Petition to the Governor-General in Council, printed on another page. It will be seen that the main issue is its unconstitutionality. The other points have been purposely stated in general terms, in order that the Committee may go into them minutely when a hearing is given by the Privy Council. In the meantime, the Petition is being numerously signed all over the Province. Any of our readers who may not yet have appended their signatures may do so at the following districts: Black Lake, John J. Penhale; Sherbrooke, F. J. Falding; Quebec, Hon. George Irvine, Q. C.; Buckingham, S. P. Franchot; Ottawa, B. T. A. Bell; Montreal, A. W. Stevenson, 17 St. John Street.

The application of electricity to mining operations is becoming more clearly demonstrated, and consequently better appreciated every day. A special feature of the Meeting, and one which attracted much attention, was the papers on electric mining plants and the experiments with the Marvin electric percussion drill. The machine was minutely inspected, all its parts being carefully examined, and its work closely watched. Although very unfavorably situated, and laboring under much disadvantage from the hasty manner in which the experiments had been arranged, the drill created a very favorable impression as a factor in mining work in the near future. Our readers will find a full description of the drill and what is claimed for it in the paper by Mr. Ward Leonard, reproduced in our report of the meeting.

Talking of electric plants reminds us that an Electro-Technical Exhibition was opened the other day at Frankfort-on-Main, at which are exhibited the latest and highest achievements of electrical science. Five different types of electric railways and an electric yacht, or launch, adequate in size to carry one hundred persons, will be exhibited. There will be, also, five different systems of long distance transmission for electric power, one of which, it is promised, will transmit 300 horse power a distance of 50 miles. Another feature of the exposition will be a series of twenty workshops adapted to different forms of mechanical work, and each equipped with the most recent and highly improved electrical tools and appliances. These shops will be manned by skilful workmen, and kept in operation during exhibition hours. Finally, there is to be an extensive scientific and industrial laboratory supplied with every material and complete apparatus for experiment and illustration.

At the Mining Conference held in Dunedin, New Zealand, an interesting paper on the "Present Position and Future Prospects of the Mining Industry" in that country, was read by Mr. James Allan, B.A., from which the following is taken:—

> "In the thirty-six years ending with 1888, the value of minerals produced in New Zealand was upwards of £52-000,000—five-sixths of this sum being from gold and silver, and about one-twentieth from coal. The production of gold has been marked by a gradual decrease since 1866, when the value of the year's work was £2,844,517, whereas in 1889 the value amounted to only £808,549. The output of coal, on the contrary, shows a steady, but moderate, increase. In 1885, the output was 511,063 tons, and in 1888 613,895 tons. The estimated available quantity of coal in the colony is 1,200,000,000 tons, of which 500,000,000 tons are brown coal or lignite, an equal quantity of pitch coal, and the remainder bituminous coal of excellent quality. Iron ore has not been worked to any considerable extent, but large deposits of good ore are known to exist, with limestone and coal, for smelting, in close proximity."

The Annual Report of the Commissioner of Mines for Nova Scotia has been presented to that Legislature. It contains, among much other interesting matter, the following summary of the mineral production of the Province in 1890: Gold, 24,358 oz., decrease, 1,797 oz.; iron ore, 51,191 tons, increase, 5,284 tons; manganese ore, 266 tons, increase, 199; coal raised, 1,984,001 long tons, increase, 227,722; coke made, 36,738 long tons, increase, 1,173; gypsum, 146,003 tons, decrease, 1,341; grindstones, etc., $8,385, decrease, $9,615; moulding sand, 170 tons, no change; antimony ore, 26 tons, decrease, 29; limestone, 35,000 tons, increase, 16,000; copper ore, 1,000 tons, increase, 500 tons.

The progress of the coal trade in 1890 was most satisfactory, notwithstanding the unfortunate strike at the Springhill collieries. The total sales were 1,786,111 tons against 1,555,107 tons in 1889. Of this, 601,956 tons were sold for home consumption, as compared with 550,425 tons in the previous year; 751,931 tons were shipped to the Province of Quebec, against 631,796 tons in 1889; New Brunswick took 224,776 tons, as compared with 195,174 in the preceding year. The sales to Prince Edward Island, Newfoundland, the United States and the West Indies were also considerably larger than in 1889.

As has already been observed in these columns, there was a very appreciable falling off in the yield of gold last year, 1,797 oz., due principally to the lack of development. In the current season, however, the deficiency will probably be made up; in several of the older districts the mines are being equipped with improved machinery, and will be in a better position to mine the lower grade quartz, which in the future is destined to become the mainstay of the gold industry in Nova Scotia. This is made evident in the detailed returns of last year: 41,886 tons of quartz were crushed, yielding 24,358 oz. for 160,264 days' labor, while in 1889, 39,160 tons produced 26,155 oz., but for 211,548 days' labor.

Among other noticeable features of the Report are a series of valuable suggestions with regard to the use of explosives, timbering, and many other points connected with the safe and economical operation of a mine, and also an exhaustive summary of the British and German experiments on the explosiveness of coal dust. Mention is made of the Jamaica Exhibition, to which a fairly creditable collection of specimens was sent and much admired. The Report closes with the full text of the enquiry into the cause of the accident at the Springhill Collieries, and the finding of the coroner's jury thereon. The conclusions arrived at are very much in line with the *Review's* comments on the accident.

That copper mines are capable of returning large profits under advantageous circumstances and skilful management, is made apparent in the annual report of the Tharsis Sulphur and Copper Company, limited, which has declared a dividend on a full issue of stock of 22½ per cent. In the last twenty-four years this Company has paid to its shareholders £4,633,432, nearly four times the amount of its authorized capital, £1,250,000, which was not until last year fully issued and subscribed for. The balance at the credit of profit and loss account was £297,487, against £249,169 in 1889, out of which £281,250 has been paid in dividends, and the remainder, £16,237, carried forward. The total extraction of ore was 501,480 tons, and the shipments 265,197 tons. The deliveries of iron ore were 206,437 tons. The outlook for the present year is favorable: the world's production of copper does not appear likely to be excessive; the Anaconda mine has been closed down indefinitely, and there seems every probability of present prices being fairly maintained. This being so, we hope to see our Canadian mines sharing in the consequent prosperity.

The last issue of the Ontario *Official Gazette* records the appointment of Mr. Archibald Blue, Toronto, to the position of Director of the Bureau of Mines, to be established under the new Mining Act. The announcement will be hailed with pleasure. Always thorough and painstaking, Mr. Blue has rendered yeoman service to his Province as Secretary of the Bureau of Industries, as Deputy-Commissioner of Agriculture, and more recently and to the point, as Secretary to the Royal Commission appointed to enquire into the mineral resources of Ontario. The editing and compilation, and some of the best work in that most valuable Report, was done by Mr. Blue, which is a sufficient guarantee of itself that his new labors will be well and faithfully performed. We heartily congratulate the Ontario Government and Mr. Blue on this appointment.

The British Columbia Legislature is ever active in advancing the mining interests of the Province, and in that respect furnishes a laudable example to the Legislature of Quebec, whose chief aim seems to be the retarding of the mining industry. It has appointed a committee to devise ways and means to promote mineral development; it has appropriated $36,000 for the construction of roads and bridges in the West Kootenai district; the five per cent. royalty clause in the "Act in aid of certain railways," (see CANADIAN MINING REVIEW, May, 1890), has been repealed by it; and charters have been granted for a railway from Fort Sheppard, on the Columbia River, to Nelson, and for one through Crow's Nest Pass to the same destination. Moreover, aid has been given to the erection of reduction works, and assistance is always forthcoming to any scheme for the material advancement of the welfare of the industry. The Coal Mines Regulation Act has been recently amended in its relation to the employment of Chinese labor, and is now much more severe, imposing a fine of not more than $5 for each day of employment in contravention of the provisions of this section, both upon the employer and Chinaman, and in actions the burden of proof is thrown upon the defendants.

Apropos of the recent discussion on the amendments to the Coal Mining Regulations of Nova Scotia, elsewhere referred to, we have received a letter from a prominent colliery manager in the Province, in which he says:—

> "The amendments were very numerous. The great objection raised in many cases was that the wording was imperfect and left room for the driving of many a 'carriage and four' through them. It was considered strange that with a Department of Mines, a Commissioner of Mines sitting in the House of Assembly and a member of the Government, that such a bill should not have been introduced in the ordinary way—it seemed a reflection on the Commissioner, Mr. Church.
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> "According to the bill, the New Year's festivities among the miners will call for the refrain: 'Certificated! For I'm certificated, and we are all certificated men!!!'
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> "The machinery for examination and registration was not devised, nor was it stated how the necessary expense was to be met. It was assumed that the Government would eagerly meet the bill of the numerous small officials that the proposers of the measure seemed to think would be required at each mining centre.
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> "One amendment proposed that all safety lamps previous to being taken into the mine, should be tested in gas by the most accurate gas-testing machine. The coal men present pointed out what seemed to them practical difficulties in the way of compliance with this ordinance. They threw their acknowledged ignorance on the mercy of the Committee and asked for information as to on whom would fall the onus of deciding from time to time which was the *most* accurate machine. It seemed as though there was a taint of the 'Shaw machine' about the clauses, but the enquiry produced only vague references to 'Patterson's process.' That beautiful process for desilverizing lead was the only 'Patterson's process' that the enquirers knew of, and so they left it with the Committee.
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> "Boys, it was proposed, should be able to 'count to fractions,' and ready concurrence was given for the law to require knowledge of the three R's. before a boy should be admitted to work; but to 'count to fractions' made too indefinite a × on the school book to please the managers, who feared suits at law for possible inattention to the Act's numerous requirements.
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> "The eight hour movement found expression in the limitation of boys' employment to 48 hours a week, which met with a vigorous opposition from Cape Breton men, whose shipping season is short and who desire to make the most of that season for trade with the St. Lawrence.
>
> "What seemed curious to some people was that this fatherly regard applied also to boys who worked in the open air, while no similar legislation has yet been introduced with reference to child labor in factories, where the atmosphere and the monotony of work are much more injurious to health than in mines.
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> "The important subject of blasting in mines producing gas came up, and by all it was felt that further restrictions should now be made. The difficulty, however, was where to draw the line, and it was settled that two findings of gas a fortnight would bar the use of explosives in customary course of working. This decision would probably satisfy most of the Cape Breton miners, but without knowledge of the actual wording it is in doubt whether the use of explosives of any sort can be continued at Pictou and Springhill. Mr. Poole contended for the wording of the English Act which, though complicated, classified mines on a danger scale, based not, as heretofore, on gas alone, but on the relative humidity and character of the dust coupled with gas. The final construction of this clause will be watched with great interest.
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> "Since writing the previous pages I have seen the last issue of the Stellarton *Journal* which, on the first page refers to the meeting at Halifax, and gives the names of those present. You will notice the praise bestowed on the managers for having behaved like gentlemen. Of course the praise of so undoubted an authority is most gratifying, and to be put on equal footing with members of the P. W. A. a greater honor than was to be hoped for."

Have coal operators any rights? This is a question often asked by the operators themselves, when some new-fangled piece of legislation is enacted, aimed at one of their sources of profit and diverting it into the pockets of their employés. The right of the miners to strike when they please have always and in all countries been recognized; to organize; to secure the passage of laws framed exclusively for their benefit, and to claim higher wages whenever the coal industry showed signs of prosperity, in all of which they have the tacit sympathy of the public and very often the support of the legislature. Those of the operators on the other hand, are not so well defined. The privilege of discharging or employing whom they will, is admitted by some, but strenuously denied by many others. The right to have their property protected in the event of a riot is another privilege not conceded by many, while others again appear to hold that they and capitalists in general have no rights whatever worth consideration.

A most flagrant instance of this feeling was evinced at the last session of the West Virginia Legislature, the members of which, like a good many other legislative bodies nearer at home, do not appear to be generally chosen for their education, judgment or sound sense, but rather for their willingness and ability to oblige the rank and file of their constituencies in the way of this and similar enactments. The miners of the State having come to the conclusion that they wanted something, finally pitched upon the weighing of coal before it was screened and the abandonment of the "unjust" system of paying them in scrip and store orders. As to the latter, it did not occur to them that with the poor credit of most of their number, they would have a hard time of it between pay days, while the former was all to their advantage. Bills were therefore framed in accordance with these resolutions, by the afore said obliging legislators, and rushed through the House. In consequence, a convention of operators was held in Charleston a short time ago, for the purpose of passing a series of resolutions expressive of their opinion of the bills passed, and of binding themselves together to secure the non-enforcement of the law and to test its validity.

The great objection to weighing the coal before it is screened is this: if a miner is paid for only clean coal, he takes his pick and makes an inbearing under the seam to a depth of about three or four feet and then drills a hole above the seam and puts in a moderate charge of powder—just enough to break off the ledge of coal his inbearing has left hanging. His effort is to get down as much weight as possible with as little breakage from the shot, because he knows that if the coal is mashed up by the discharge of the blast he will not be paid for it. On the other hand, if he is paid before the coal is screened his only effort is to get out the greatest possible quantity, and he does not care whether it comes out in the form of slack, badly broken up, or whether it comes in good, saleable lump coal. Powder is very cheap, and by putting in a heavy charge the miner can break down and dislodge in small bits twice as much coal over the same inbearings as he could with a small shot when his effort is to get the coal out in lumps. Under the proposed arrangement it makes great difference to the operator, except in a few districts where the slack is used for the purpose of making gas; otherwise it is entirely unsaleable. It cannot be shipped, and must usually be thrown into some convenient dumping ground or given away for the sake of getting rid of it. Regarding the making payment in scrip or store orders the law might easily be avoided by trusting the miner to the extent of his wages, but this course would be decidedly objectionable. The question will probably be fought out in the courts.

Probably one of the most notable of recent mineral discoveries in Canada is that of a vast deposit of amber on Cedar Lake, near the mouth of the Saskatchewan River, reported by Mr. J. B. Tyrrell of the Geological Survey. It occurs mixed with sand and many fragments of partly decayed wood on a low beach behind a gradually shelving shore and along the face of a deep wet spruce swamp. The pieces were for the most part smaller than a pea, but could be readily seen glittering among the sand and vegetable *debris*. Some pieces were found as large as a robin's egg, and it is stated that others much larger have been picked up. Mr. Tyrrell says: "It is difficult to make an accurate estimate of the quantity of amber on this mile of beach, but it may confidently be said to extend throughout the distance in a band thirty feet wide, with a minimum depth of two feet. This band has thus a total bulk of 316,800 cubic feet. A number of specimens collected from various parts of it, showed an average of a little over ten per cent. of amber, which, in natural fragments, weighed about forty-six pounds to the cubic foot. The amount of amber on this strip of beach would therefore be about 31,680 cubic feet or 1,457,280 pounds. At a minimum value of twenty-five cents a pound, this would represent a total of $364,320. This estimate refers merely to the material that is now washed up on the ridge of the beach, without considering the source from which it is originally derived."

Another remarkable instance of the manner in which the too-confiding English investor is duped by the unscrupulous company promoter, has just been ventilated in the Chancery Division in England, before Mr. Justice Sterling. The case was a shareholder's petition to wind up the Anglo-Austrian Printing and Publishing Company, a concern formed to acquire five printing businesses in Austria. A certain Mr. Horatio Bottomley was the promoter, a gentleman who is figuring in the courts in another winding-up suit, that of the Hansard Union Publishing Company. The chairman was Sir Henry Isaacs, late Lord Mayor of London, and Mr. Bottomley himself was vice-chairman. Over £90,000 in cash was subscribed, and of this sum only £26 5s. remains, the rest has disappeared. No businesses have been acquired, and there is nothing to show for the money. One dividend of 8 per cent. was paid out of the capital, the directors were liberally remunerated, and the remainder has been appropriated by Bottomley. At one time he drew £75,000, and several smaller sums afterwards. The credulity of one class of Englishmen is almost beyond belief, but these constant exposures of swindles are likely to turn them to the opposite extreme and make them as suspicious as they previously were confiding—a feeling much better for their own pockets, but exceeding hurtful to genuine enterprises put upon the market.

Successful Meeting and Dinner of the General Mining Association of the Province of Quebec at Montreal.

The first quarterly general meeting of the General Mining Association of the Province of Quebec was held in the new club room of the Windsor Hotel, on Wednesday, 29th ulto. Owing to the late arrival of some of the trains, the opening session was not held until close upon eleven o'clock, when there were present :—A. M. Evans, M.E., Bell's Asbestos Co., Black Lake ; D. A. Brown, Bell's Asbestos Co., Boston ; L. Klein, M.E., American Asbestos Co., Black Lake ; John J. Penhale, United Asbestos Co., Black Lake ; Richard Penhale, Albert Mines, Capelton ; W. H. Irwin, and R. T. Hopper, Anglo-Canadian Asbestos Co., Montreal ; H. J. Williams, Beaver Asbestos Co., Thetford ; C. Koenig and C. Cirkel, Templeton Asbestos Co., Templeton ; A. H. Murphy, Thetford Asbestos Co., Thetford ; Hon. George Irvine, Q.C., Johnson's Asbestos Co., Quebec ; J. Lainson-Wills, F.C.S., General Phosphate Corporation, Ottawa ; S. P. Franchôt, Emerald Phosphate Co., Buckingham ; T. P. Bacon, New Rockland Slate Co., Montreal ; J. B. Smith, M.E., Anglo-Continental Guano Works Co., Glenalmond ; O. M. Harris, Canadian Phosphate Co., Montreal ; G. R. Smith, Macgregor Lake Phosphate Co., Templeton ; Dr. W. T. Gibbs, Dominion Phosphate Co. of London, Buckingham ; F. D. Taylor, M.E., Montreal ; W. H. Jeffrey, Richmond ; F. Bacon, Park Bros. & Co., Montreal ; Prof. Harrington, Montreal ; G. W. Schleisinger, M.E., Boston ; E. J. Brainard, Hamilton Powder Co., Montreal ; F. A. Barr, Edison Electric Co., Toronto ; M. D. Barr, Toronto ; W. Hamilton-Merritt, M.E., Toronto ; J. T. Donald, M.A., Montreal ; T. Kirkhouse, Montreal ; E. Ward Leonard, Edison Co., New York, J. W. Kirkland, Thomson-Houston Electric Co., Boston ; Hector McRae, Ottawa ; W. P. Lockwood, St. Francis ; B. T. A. Bell, Editor CANADIAN MINING REVIEW, and others. There were also present a number of science students from McGill University. Hon. George Irvine, Q.C., in the chair. The minutes of the last meeting having been read and confirmed, the following new members were elected : J. Lainson-Wills, Ottawa ; T. M. Williams, Billerica ; W. H. Jeffrey, Richmond ; W. T. Gibbs, Buckingham ; W. P. Lockwood, St. Francis ; D. A. Brown, Boston ; F. D. Taylor, Montreal ; C. Magee, Ottawa ; James Cooper, Montreal.

Report of the Council on the Quebec Mining Act.

HON. GEORGE IRVINE said : Since the last meeting of the Association the Committee appointed for this purpose took some action with regard to carrying out the intentions of the Association respecting the mining Act recently passed by the Quebec Legislature. After communicating with Mr. Mercier on the subject, he appointed a meeting with the committee, and we attended accordingly. Mr. Mercier expressed a desire to look thoroughly into the matter, and asked me to make a statement of my views with regard to the difficulties which existed, and this I promised to do. Owing to the general elections, which took place shortly afterwards, he deferred his departure to Europe, and requested me to send a statement, of which the following is a copy, to the Attorney-General :—

Copy Memorandum on the Quebec Mining Law, Submitted to the Hon. the Attorney-General.

In order to understand the objections on constitutional grounds taken to the recent Mining Law passed by the Legislature of the Province of Quebec, it is important to consider how the law stood previous to the passing of that Act, and what the rights of persons holding mining lands were.

It has always been held that minerals not being gold and silver, belong to the owner of the soil, and that grants from the Crown in which there is no reserve, convey the ownership in the minerals to the grantee. The course of legislation in this Province and the jurisprudence of our courts fully establishes this.

The first regulations adopted by the Crown Lands Department respecting the sale of mining locations were passed in 1874, and may be found in the report of the Commissioner for that year. These regulations were in force when the Act of 1880 was passed, and a large number of grants were made under it. The lands so granted, except in so far as respects the Royalty or tax imposed by the recent Act are not affected by it.

The Act of 1880 carefully guarded all vested rights—it provided (1422) S. 3, "It shall not be necessary in any Letters Patent for lands granted for agricultural purposes to mention the reserve of mining, which reserve is always supposed to exist under the provisions of this section." The grantees of lots for agricultural purposes whose titles date subsequent to the passing of this Act are guaranteed the right in the event of their discovering minerals on their lots to acquire the right to the full mining property by paying the difference between the price of mining property and what they had paid for an agricultural lot. It will be seen by this that no interference with the rights of property were attempted. The rights of owners of property granted by the Crown were not interfered with, and they remained with their ownership quite undisturbed.

The whole of this existing state of things is changed by the Statute now complained of—Clause 1425, which is substituted for the former clause designated by the corresponding number, enacts : 2. "As it is admitted that mines, whether upon public or private lands, belong to the Crown, any person discovering a mine may purchase the same by complying with the provisions of this section.

It is submitted that no enactment corresponding to this can be found in any legislation heretofore passed by any dependency of the British Empire, still less in the Imperial Parliament, for it not only in a few words takes the property from a large number of Her Majesty's subjects, but falsely asserts that the right to do so was admitted. It would be interesting to find the person who admitted that the Government had the right to take his property from him, and it further seems unnecessary, if it were universally admitted that the baser metals belonged to the Crown and not to the owner of the soil, to pass a Statute altering the existing law, and declaring that such minerals belong to the Crown.

The Statute to which we object then proceeds from Section 1455 to 1512 ; to provide for the means by which any stranger, on obtaining a permit from the Government, may proceed to expropriate the mine, which happens to be on private lands, and take it away from the proprietor unless the latter chooses to pay the price which may be determined on ; the law, however, giving to the proprietor the option of buying his own property if he is willing to submit to this imposition.

It is submitted that this Statute interferes with private rights in such a way as to render its disallowance necessary and constitutional.

(Signed), GEORGE IRVINE,
President General Mining Association
of the Province of Quebec.

QUEBEC, 31st March, 1891.

So far, I think our interview with Mr. Mercier, although it has not yet produced any beneficial results, was satisfactory as far as it went. In the meantime I have drafted a petition containing fuller information than the previous one, praying for the disallowance of this Act, which I will submit to this meeting, and will be glad to make any changes that may be deemed necessary.

The Petition to the Governor-General-in-Council.

To His Excellency the Right Honourable Sir Frederick Arthur Stanley, Baron Stanley of Preston, &c., &c., Governor-General of the Dominion of Canada, in Council, Ottawa.

The humble petition of the undersigned proprietors of of mining lands, and persons interested in mines in the Province of Quebec, represents :

That there was passed at the last Session of the Legislature of the Province of Quebec, an Act intituled, "An Act to Amend and Consolidate the Mining Law."

That your petitioners respectfully allege that the said Act is unconstitutional, that it has a retroactive effect, that it interferes with private rights unjustly, and confiscates private property, that it is contrary to the policy of the Dominion, and is injurious to a large and increasing commercial industry.

Your petitioners submit to Your Excellency-in-Council the following grounds on which they ask for the disallowance of the said Act.

1. Sub-section 2, of clause 1, repeals the existing law contained in Article 1425, of the Revised Statutes of Quebec, and enacts : "As it is admitted that mines, whether upon public or private lands, belong to the Crown, any person discovering a mine may purchase the same by complying with the provisions of this section." Your petitioners represent that it is not a fact that it was ever admitted that minerals, other than gold and silver, on conceded lands, belonged to the Crown ; but that on the contrary, the whole course of legislation and jurisprudence in the Province of Quebec, as well as the system of administration by the Crown Lands Department of the Province, admitted the contrary to be the case.

2. The Statute complained of proceeds to provide, from section 1455 to 1512, for a system of confiscation of the minerals on private lands ; any person desirous of acquiring the minerals on the land of another, obtains from the Government a permit of exploration, and after satisfying himself of the quantity of land which he will require, a surveyor's plan, with an offer of price is deposited with the Commissioner, and unless the proprietor elects to pay the price offered, the property in the minerals passes to the holder of the exploration permit.

3. The statute law of the Province of Quebec, as it stood previous to the passing of the Act in question, is to be found in the Revised Statutes, from Article 1421 to Article 1582, inclusive, which articles are taken from the Act of 1880, chapter 12.

4. Previous to the passing of this Act the Department of Crown Lands had made regulations for the sale of the Crown Lands containing mineral deposits, by which the price of such lands was increased as compared with lands sold for agricultural purposes.

5. Article 1423 provides : "It shall not be necessary in any Letters Patent for lands granted for agricultural purposes, to mention the reserve of mining rights, which reserve is always supposed to exist under the provisions of this section.—43-44 V., c. 12, s. 3."

Articles 1425, 1428 and 1429 enact : "Any person who, previous to the 24th July, 1880, obtained Letters Patent for agricultural purposes, but with reservation by the Government of the mining rights, any lot whatever forming part of the public lands of this Province, may, if he or his legal representative discover and wish to work a mine, purchase the mining rights so reserved by the Government, by paying in cash, to the Commissioner, over and above the price already paid for said lot, a sufficient additional amount to make up the sum of two dollars per acre, if for gold or silver, and one dollar per acre if for copper, iron, lead or other baser metals.—43-44 V., c. 12, s. 4."

Article 1428 : "If, on any lot of land granted by Letters Patent since the 9th March, 1878, or which shall hereafter be granted, on the usual terms and conditions, for agricultural purposes, a mine of phosphate of lime has been found to exist, any purchaser of such lot, or his legal representative, shall, if he wish to work such mine, pay in cash to the Commissioner, a sufficient additional amount to make up the sum of two dollars per acre.—43-44 V., c. 12, s. 7."

Article 1429 ; "Every person who may acquire by Letters Patent, on the usual terms and conditions, for agricultural purposes, any lot whatsoever upon which he may discover a mine of baser metals, excepting phosphate of lime, shall, if he or his legal representative wish to work the same, pay to the Commissioner a sufficient additional amount to make up the sum of one dollar per acre.—43-44 V., c. 12, s. 8."

7. The law of 1880 thus carefully leaves the titles of those who held lands under agricultural grants without reservation of minerals untouched, and grants to those in whose grants the minerals had been reserved, as well as to those who had obtained grants since 1880, the right to purchase them on paying the difference between the agricultural and mineral prices.

8. The statute now complained of takes from those whose grants were made previous to 1880 the right of ownership in the mines which had not been reserved by the Crown, and which were their undoubted property, and deprives those who had purchased agricultural lots since 1880, and lands on which phosphates are found, granted since 1878, of the right guaranteed to them by these laws of becoming owner of the minerals by paying the difference in price.

9. The clause 1426 of the Act complained of, imposes on all mineral properties a tax, (therein styled a Royalty), "of three per cent. of the merchantable value of the product of all mines and minerals."

10. The imposition of this tax will be most injurious to the mining interests, and in some cases will entirely prevent the carrying on of mines, in those cases where the margin of profit is small, which your petitioners undertake to prove to Your Excellency-in-Council.

11. This action of the Provincial Legislature is contrary to the general policy of the Dominion, as your petitioners believe, the Parliament of Canada having at its session of 1890 granted encouragement to your petitioners by removing the duty on machinery imported for the use of mining operations, which policy is overturned by the imposition of such a tax.

12. That the said Act is *ultra vires* and unconstitutional.

Wherefore your petitioners humbly pray that Your Excellency will be pleased to exercise the power conferred on you by the British North American Act, and disallow the said Bill.

THE CHAIRMAN, in answer to a question by Mr. W. H. Irwin did not think it necessary to embody details in the petition.

Note on the Quebec Mining Law.

MR. BELL then read the following letter from Dr. Rossitter W. Raymond, Secretary of the American Institute of Mining Engineers :—

SIR,—I beg to acknowledge with thanks the copy of the new Quebec mining law, which you have kindly forwarded to me. Having but just returned from an absence of several months, principally spent in Egypt or on the ocean, I was not acquainted with the provisions of this law, and could scarcely credit the reports concerning them which came in a fragmentary way to my attention.

I have examined, therefore, with curiosity, the printed text of the law ; and I confess that my surprise is now greater than ever. I did not deem it possible that the legislature of any civilized country could at this day be induced to enact a measure so barbaric in its injustice and unwisdom. Of the particulars which embody the injustice of the law, the following struck me as the most important, though not the only ones :

1. As I understand it, the law imposes a "royalty" of 3 per cent. of the gross value of the product upon mines already alienated from the Crown by actual sale without any reservation of the right to levy such a royalty. The exact effect of the phrase "unless otherwise determined by letters patent already granted," in paragraph 1426, I may, perhaps, fail to appreciate correctly. I do not know the precise form of such letters patent ; and I am led to believe that the form has varied at different times, and in different cases. But it seems clear that under paragraph 1435 of the Quebec law hitherto in force, the

right to exact royalty is qualified by the phrase, "unless such royalty be otherwise established by letters patent *or other title from the Crown*," the latter half of which is omitted in the new law. Moreover, that paragraph confines to gold, silver and phosphate of lime the royalty therein specially referred to.

Paragraph 1425 of the old law provides for the purchase of the mining rights expressly reserved by the Government in letters patent granted before July 24, 1880; and the only requisite is a payment of additional sums, sufficient with former payments to make $2 per acre for gold or silver and $1 per acre for other metals.

Paragraphs 1423, and 1426 to 1434 inclusive, provide similarly for all cases arising under letters patent; and the last named paragraph, together with paragraph 1545, authorises the increase from time to time, by the Lieutenant-Governor in Council, but cannot be construed as affecting the rights of those who had before such increase made the prescribed payment, and in the language of paragraph 1425 *purchased* the mining rights. In other paragraphs, the phrase is sometimes varied, and the right to "work" the mines is mentioned, but without any limitation as to time; and it is impossible to construe the payment per acre, thus provided for, as anything else than a purchase outright, or the tender and acceptance of a lump sum in lieu of all royalty forever.

The new law seems to levy a royalty even upon mines, the rights to which have been legally alienated from the Crown already. I have no doubt that if this be held to be its force, it will stand self-condemned as unconstitutional. Such a levy is no longer royalty at all. It is illegal taxation, or rather confiscation. Probably words are wasted in discussing this possible aspect of the case. The courts of a free country may be relied upon to defeat any such formal violation of justice.

But in another aspect the legal remedy may not be so clear; and the view I venture to suggest is therefore offered with less confidence. Yet it seems clear to me that the land owners coming under the provisions of the old law above cited have certain vested rights, aside from those which they may have acquired by supplementary payments per acre, or by absolute purchase in any other way of the mining rights of the Crown.

The law, taken as a whole, embodies the inducements held out by the Government to purchasers of land. One of them is, that the purchaser of agricultural land may, if he find ores of iron, copper, etc., buy for an additional sum per acre the right to such deposits. If he afterwards finds gold, silver, or phosphate, a further payment per acre will buy the right to these also. He is warned by paragraph 1434 that these prices per acre may be increased at any time; by paragraph 1435 that, as to gold, silver and phosphate, he will have to pay royalty unless he has obtained under preceding paragraphs, the "other title from the Crown" therein provided. But he is not warned that the Government may at any time decline to accept any lump sum whatever per acre in lieu of royalty, and enforce a ruinous royalty on mining of all kinds.

Now the question is, whether there is not an implied promise, on the part of the Crown, involved in these provisions, on the faith of which purchasers of lands have acted. Is it not an inducement to the purchaser of agricultural land that if he should find it to contain valuable mines he can buy the mineral right for an additional sum per acre? Or is it not an inducement to the purchaser of iron or copper-bearing lands that he may if phosphate or gold or silver should be discovered in them, buy the right to these for an additional sum per acre? Granted that the Government has reserved the right to increase at any time this sum as to any lands upon which the purchasers' option has not been exercised; granted also, that, under the terms of the law, the Crown remains in possession of the mineral right; yet is it not true that although that right has not been alienated, an option to buy it has been offered as a bonus to the purchaser of other rights?

It must be remembered that the substitution of a royalty, even of a reasonable amount, is not a mere modification of the procedure of a sale, for the purchaser of mineral rights has thereafter the free choice to work the mines or let them lie idle, as he may deem most to his interest. But under the system of royalty contemplated under the new law as universal, the previous purchaser of land is subject to the intrusion of licensed prospectors, and is forced, upon discovery of mineral alleged to be valuable, to work the mines or else let others work them.

I am not now inquiring whether this system would be wise as applied to the administration of Crown lands henceforward; but whether it does not involve a violation of good faith and obligation when applied to the purchasers of lands heretofore. In any such controversy between private parties, the courts would inquire whether the purchaser had performed, in pursuance of the alleged agreement, any acts which he would not have performed in the absence of the inducements offered. The answer to that question in the present case is, I take it, perfectly clear; and the proof will be speedily forthcoming if the new law goes into operation. Capitalists will certainly not wish to buy even agricultural lands to which they cannot somehow obtain a complete title, excluding all private trespass and official interference. Nor will they invest in mining rights held under royalty and subject to forfeiture. Mortgages upon such property will have no value as security; and what will be is only what would have been if the old law had been like the new one in these respects. But the old law held out inducements on the faith of which capital was invested or loaned. Hence, it seems to me, the new law violates an implied contract as to all purchasers of land under the old.

But whether this be legally the case or not, the essential injustice of the new law is plain enough. If it is not unconstitutional, it is unfair.

Aside from these features, the new law is unjust in that it singles out for taxation a particular industry—and the most laborious and precarious of all the productive industries. I do not mean to say that mining skilfully conducted may not be largely profitable; but it would be folly to deny that it presents peculiar risks, and that the profits of fortunate and well managed enterprises are offset in the calculation of general results by the cost of much fruitless exploration and many deserved and undeserved failures. The stimulus to industry in this field is the hope of exceptional good fortune. This it is that keeps prospectors at work, and commands a perpetual supply of capital for experiments and developments. Consequently, mining less than any other industry can bear a burden laid equally upon the successful and unsuccessful. Yet this law not only selects mining for special taxation, but practically discriminates against the unfortunate by taxing gross product instead of profits or dividends. I am not now saying that this is foolish and suicidal, but that it is unjust.

I might go on to characterise in a similar way the harassing restrictions thrown around mining operations under the law, the system of petty official espionage and tyranny ordained by it, etc. But these are part and parcel of the fundamental injustice which it contemplates.

I will add a few observations as to the unwisdom of the law, apart from its injustice. To make this special aspect clear, let us suppose the new system to be applied to Crown lands and their future occupants only. This was the case, for instance, with the Federal mining laws of the United States, of 1866 and 1872. They concerned exclusively the mineral lands of the public domain in certain States and Territories. It is much to be regretted that the Quebec law was not similarly limited. In that case, it would have furnished an interesting, instructive and not disastrous object lesson to the legislators of the province. For they would have seen very quickly that no capital would submit to its vexatious conditions, and no revenue would result to the government.

Who is going to pay for the privilege of exploring for minerals if the owner of the land has the preferential right to take the mine he may develop?

Who is going to make explorations even on his own land, if every pit he digs must be fenced and kept fenced forever?

Who is going to put money into the development of a mine which he cannot allow to lie idle if he finds that it is temporarily unprofitable, or if he gets involved in a lawsuit about way-leaves or damages or boundaries?

Who is going to bind himself to make monthly or quarterly returns of minute business details to a government bureau, or furnish complete maps and descriptions of all workings? It must be remembered here that the law provides for no use to be made of these data, beneficial to the mining industry. It establishes no body of trained and skilful engineers, whose supervision or advice might be really of service. The reports thus exacted will be simply a mine of information for informers, blackmailers, and opposing litigants, and the business of mining under such regulations ceases to be a private enterprise at all.

No doubt some enthusiastic reformers will say that the State ought to work the mines anyhow. We have such people on this side of the line, and perhaps they exist in Quebec; but I need not discuss that proposition here. I will only observe that under the new Quebec law, the State might as well prepare to work such mines as are not now in private hands, for I do not believe that private capital will undertake enterprises in which the public is to be a confidential, irresponsible and meddling partner.

I see that the Premier of Quebec has declared the motive of the law to be the obtaining of increased revenue. It is quite possible that certain concerns now profitable may yield something for a while under this process of squeezing; but unprofitable enterprises will not go on; capital will not be forthcoming for new ones; the goose will lay but one golden egg, and then die.

The folly of this scheme as a whole is carried into its minor details. A little acquaintance with mining should convince anybody that three per cent. on gross value would be a very unequal tax on the different substances enumerated. Levied as directed on the gross weight of gold, it would be, on low grade ores, ten or twenty or fifty per cent. of the net profit of the miner; and it would strike a fatal blow at the mining and treatment on a large scale, at small net profit per ton, of the auriferous ores of that class. In fact, the law is so contrived as to rest least heavily upon the miners of rich, concentrated materials, who employ proportionally the least labor, and benefit the country least, while it bears most heavily upon those who spend most money in wages, freights and machinery, carry on the most expensive business, and are content with the smallest profits per ton of raw material.

A more ingenious contrivance for injuring a fundamental industry, and with it all the business of the province, it would be difficult to invent.

Of the army of inspectors and informers, and the catalogue of petty offences and fines created by this law, I can hardly speak with patience; and perhaps it does not become me to say much on that subject. We are cursed in the United States with too many officials, and with the evils of too much "patronage" in the hands of our government. Until we get our own civil service, federal, state, and municipal, into a more satisfactory condition, we should not indulge in too free a criticism of our neighbors. I am sorry, in a sympathetic way, to see the people of Quebec exposed to the same evils, and in a form apparently worse than we are called to suffer; but after all, that is their business, not mine. Such citizens of the United States as are not so unfortunate as to be always involved in mining enterprises in the Province of Quebec, will have no cause to complain if this new law goes into effect. They have only to keep their money at home, or invest it in regions more justly and wisely ruled.

A vote of thanks to Dr. Raymond for the trouble he had taken was unanimously carried.

The Chairman said it was desirable that the Association should adopt a resolution authorizing the presentation of the petition to the Governor General in Council praying for the disallowance of the Quebec Mining Act, and suggested that the committee appointed at a former meeting be authorized to present it. Carried.

Note on the Law Respecting Powder Magazines in the Province of Quebec.

The Chairman submitted Articles 875 and 876, paragraph 17, Revised Statutes of Quebec, as follows:

875. Every person keeping a magazine for the storage of powder, or who sells and holds for sale any quantity of powder, must obtain from the Collector of Provincial Revenue a license to that effect.—41 V., c. 3 s. 60; 46 V., c. 6. s. 1.

876. No license can be granted for keeping a powder magazine within the limits of the City of Quebec and Montreal, or within a radius of five miles therefrom, or unless the building be erected according to the following rules:

1. Every magazine shall be built of stone at least two feet in thickness, covered with a fire proof roof made of metal, and adhering to the building by its own weight only.
2. It shall be enclosed, at a distance of at least ten feet clear, by a stone or brick wall at least ten feet high, with a stone coping having a single opening, of which the door shall be covered with brass, copper or zinc, and shall be so placed as not to open on any public highway, or on the side on which is the door of the magazine.
3. In the construction of the magazine or in the surrounding wall, only stone, brick, copper, brass, wood, glass, tin, slate, zinc, or leather can be used.
4. It must have but one entrance, to which two doors with copper fastenings shall be placed, one inside and one outside the wall; both made of brass, copper or zinc, or covered with the same material.
5. The floors shall be tongued and grooved and close-jointed, and each part thereof on which any person might walk or place his foot shall be covered with leather.
6. It shall be provided with two lightning rods, to be approved of by the Collector of Provincial Revenue.

Any powder magazine may, with the consent of the Lieutenant Governor in Council, be constructed in a different manner.—41 V., c. 3, s. 61; 46 V., c. 6, s. 1.

The Chairman said: We all know the importance of taking such precautions as will render the powder magazines, which are an essential part in all mining operations, safe for the public and for the people who use them. We have on this subject a law which is apparently a good one. We have in Articles 875 and 876 of the Statutes a provision which lays down so far as regards the Cities of Quebec and Montreal and their immediate neighborhoods, a rule for a special magazine constructed in a particular way—special directions as to the kind of magazine that is required. It also requires that every one in other parts of the Province who have magazines, whether such are required either for the use of the person to whom they belong, or for storage purposes, that a license should be obtained from the Provincial Government, and a plan or specification of the magazines proposed to be built furnished to the Provincial Secretary. If the magazines are approved, the Government issues a license, the tax being $150. These are the existing regulations on the subject. I cannot say that it is desirable in the interests of mining companies, or the persons owning the magazines, that this law should be strictly complied with. It does not at all follow in the event of its not being complied with, that because an accident occurs, the owner of the magazine is liable for such accident unless it can be shown that the accident occurred through some neglect of the owner of the magazine. Besides that, if a license has not been applied for, and a magazine is kept without such license, the owner is liable to a penalty provided for in the Act. I am of the impression that this law is not being complied with at all; it may be in some places, but I am quite sure that there are a very large number of cases where this law has been disregarded. I had myself a plan of a magazine recently prepared, which I have sent in to the Government, and have reason to believe they will adopt it. It is stated by those who profess to understand something about the matter to be a safe kind of a magazine, and not by any means an expensive one. It is satisfactory to know that much. I may say that it will strike every person present as being most desirable in their own interest that the laws should be followed out. A plan of the magazine should be submitted to the Provincial Secretary and a license obtained, because in the event of an accident occurring, although it might not absolutely relieve the owner of the magazine from all responsibility, notwithstanding the fact that he has had the plan of his magazine approved of and obtained the Government's sanction, it would undoubtedly be a very strong point in his favour. I commend it strongly to the consideration of all gentlemen who have powder magazines, and who are interested in the subject.

Mr. W. H. Irwin.—I understand that in the new Mining Act they do not specify the class of magazine that is to be used.

The Chairman.—The new Mining Act does not touch the magazines at all.

Mr. L. A. KLEIN.—What I am afraid of is this: If the license will be raised say to $150 and expensive magazines be put up, this will induce the mine owners to put up one general magazine and keep a lot of material together, which, I think, would increase the danger.

Mr. W. H. IRWIN.—Every mine owner is as careful as possible. Take our own district—during the time we have worked there, we have not had one single accident, except last year, when we had a blow-up from lightning. No magazine will prevent that, and now we keep our material at two or more different places to avoid danger. Now if a high license be placed on our magazines, all the miners will join together and probably keep a large quantity of dualin in the one magazine, which will be more dangerous than at present. He asked whether it would be contrary to the law for several mine owners, as Mr. Klein suggested, to join together and erect a large magazine for the purpose of keeping their stores therein. He thought the object of the Quebec Government was to derive revenue from this license, and that it might be a violation of the Act, inasmuch as half a dozen different companies would only pay one license of $150 in lieu of several.

Mr. KLEIN thought that it would not be necessary for the mine owners to do that. The suppliers would put up the magazine and the mine owners would buy their explosives daily. Nothing could prevent that and the Government would get the $150 license and twenty thousand tons might be stored there.

The CHAIRMAN remarked that the mines of the asbestos district were within a comparatively small circuit, and there would be no great inconvenience in keeping their explosives in one magazine.

Mr. W. H. IRWIN said that so far as the convenience of the miners was concerned, he thought it would be a great advantage over the present system, but at the same time the Quebec Government would consider that an evasion of the Act so far as it related to the license and the revenue to be derived.

Mr. A. M. EVANS remarked that the law of taxation would be all right if a man were to go to Thetford and put up a powder magazine for the purpose of selling that powder to miners, but the law has no right to tax the individual miner. It might as well tax him for his bread and cheese.

The CHAIRMAN, in answer to a question, stated that a magazine of the kind he had submitted to the Government would not cost more than $500 or $600.

Mr. W. H. IRWIN stated that last year their magazine was struck by lightning and that had it been built according to the plans suggested in the Act not only would the magazine have been blown to pieces, but being of stone and solid material would have done a great deal of damage. Their magazine was a wooden building on the top of a mountain and practically no damage was done.

The CHAIRMAN stated that the kind of magazine suggested was more for preventing explosion than for considering what the effect of an explosion would be if it took place.

The Responsibilities of the Mine Manager.

This subject was eloquently handled by Mr. A. M. Evans, Manager for Bell's Asbestos Company at Black Lake. Mr. Evans touched upon (1) The responsibilities to ourselves; (2) The responsibilities to our employers; (3) The responsibilities to our employees. He spoke strongly in favor of greater educational facilities for the miner, and advocated closer attention to sanitation in mining settlements.

An Invitation to Visit McGill University.

Prof. B. J. HARRINGTON, on behalf of Sir William Dawson, invited the members to visit the Redpath Museum, and to attend the Convocation of the Faculties of Arts, Law and Applied Science, to be held in the Windsor Hall on Thursday.

Mining Bureaus.

Mr. W. HAMILTON MERRITT, Toronto, having been called upon, to address the meeting, said: I received with great pleasure the kind invitation of this Association to attend your first quarterly general meeting, and as it came at a time when we were endeavoring to interest the people of Ontario in mining matters, I felt it important that I should be here to attend what I consider an extremely important event. I hope that we in Ontario will be able to follow your example and form a similar association, because I am confident that anyone who has the interest of mining development at heart must have come to the conclusion that combined effort is absolutely necessary in order to obtain that measure of recognition from the Government which the status of the industry and the extent of our mineral resources warrants. He commented on the recent Mining Bill introduced at the last session of the Ontario Government, pointing out the absurdity of having the operations of the Mining Act controlled and directed by the Department of Agriculture. He also advocated a closer recognition of commercial data by the Dominion Government, either in the present Bureau of Mining Statistics in connection with the Geological Survey, or elsewhere.

Mr. B. T. A. BELL pointed out the utter inefficiency and incompetency of the so-called Mining Bureau, attached to the Department of Crown Lands in Quebec, stating that until the Government consulted with trained and experienced mining inspectors, well versed in the wants and uses of the industry, it was hopeless to expect proper mining legislation. If the local Government had followed the example of the Province of Ontario, and appointed a competent commission to enquire into the requirements of the industry, he was sure no such iniquitous measure as the recent Quebec Mining Act would ever have been attempted. The Dominion Government had done much to foster our manufactures, to extend colonization, to build railways, to develop our great agricultural resources. What had it done to promote the most staple industry of them all, the development of our mines? The Geological Survey, it is true, had accomplished much, and deserved a more generous recognition. It must, however, be regarded as a scientific institution. Was there not an urgent demand for some department or section of a department where commercial data would be readily accessible. The present Statistictical Bureau operated by the Survey was practically useless as a means of supplying that commercial information respecting our minerals so much sought after by investors from other countries.

Mr. W. H. IRWIN: I quite agree with Mr. Bell that this matter should be taken up by the Province, and that there should be established a proper bureau of mines, whose duty it would be to supply the public and miners with information bearing upon mining affairs. Of course, heretofore, the answer to that would have been, I suppose, that the mining community did not contribute sufficient revenue to warrant the expenditure. But as it seems to be the intention of the Provincial Government to tax mining property in some form or other, I think now is the time to bring the matter to official notice. He moved that the Secretary be empowered to prepare a resolution to be submitted to the Quebec Government. Carried.

This terminated the morning session.

In the afternoon Mr. J. T. Donald, M.A., Montreal, read the following paper on

The Chemical Composition of Asbestos.

Having of late devoted some time to the analysis of samples of asbestos from different localities, I have decided to lay before you some of the results obtained. These, I trust, may be of interest both to those who are engaged in mining in the asbestos districts of Eastern Quebec as well as to those whose labors are among the Laurentian rocks. I shall confine my attention to three points.

I. *Comparison of Canadian with Italian Asbestos.*—When Canadian asbestos was first placed upon the market it had to compete with the Italian mineral, and it is matter for regret that attempts were made to decry the Canadian article and to prejudice users by the statement that chemical analysis showed the latter to be inferior to the Italian. From different sources samples of the Italian were procured, some of which are now before you. An analysis was made of the best sample and the results are shown in column 1. Column 2 shows the composition of a sample from Broughton. The Broughton fibre was taken for analysis because of its marked freedom from foreign matter, the Thetford samples first selected for that purpose having been damaged by fire and smoke.

	ITALIAN	BROUGHTON	TEMPLETON.
Silica	40.30	40.57	40.52
Magnesia	43.37	41.50	42.05
Ferrous oxide	.87	2.81	1.97
Alumina	2.27	.90	2.10
Water	13.72	13.55	13.46
	100.53	99.33	100.10

Certainly chemical analysis shows that our Canadian fibre is in no wise inferior to its European rival.

II. *The cause of the harshness of fibre of some asbestos.*—Chemical analysis throws light upon this important point. From the analysis given above it may be seen that asbestos is principally a hydrous silicate of magnesia, *i. e.*, silicate of magnesia combined with water. It must be borne in mind that this water is not present as moisture, the moisture of bread for example, which can be driven off at a temperature of 212° Fah.; it is water more intimately associated with the silicate, but which may be dissociated therefrom and driven off by a high temperature, just how high I have not yet determined.

When harsh fibre is analysed we find it to contain less water than the soft fibre. In fibre of very fine quality from Black Lake analysis showed 14.38 per cent. of water, whilst a harsh-fibred sample gave only 11.70 per cent. It is well known that if soft fibre be heated to a temperature that will drive off a portion of the combined water there results a substance so brittle that it may be crumbled between thumb and finger. There is evidently some connection between the consistency of the fibre and the amount of water in its composition. It is probable that the harsh fibre was, as originally deposited, soft and flexible, and has been rendered harsh by having a portion of its water driven off by heat, either produced by movement of the associated rocks or resulting from the infection of molten matter through volcanic action.

III. *Comparison of Cambrian with Laurentian asbestos.*—Up to the present time Canadian asbestos may be said to have been obtained exclusively from the Cambrian rocks of eastern Canada. Of late, however, indications have not been wanting to show that it is possible that the great belt of Laurentian rocks to the north of the St. Lawrence may yet prove to be a rich source of this mineral. It has long been known that seams of short fibre are to be found in those rocks, but it is only within the last year that any attempts have been made to test these veins, and it is gratifying to be able to state that the results of these attempts are promising. Much of the Laurentian serpentine is different from that of Thetford and Black Lake. It is much lighter in color and is remarkably free from desseminated chromic and magnetic iron. The contained asbestos is, like the serpentine, of a lighter color than that from the Cambrian, and in consequence of the absence of iron there is little or no tendency to discoloration from percolating water. Is this Laurentian asbestos as suitable for use in the arts as is the Cambrian variety? Column 3 above gives the analysis of a sample from the Laurentian of Templeton, from which it is seen that so far as composition is concerned the two are practically of equal value.

In conclusion your attention is directed to the specimens before you. The world is being searched for asbestos, particular attention being paid to South Africa, which is considered a promising field. These specimens are said to be fairly representative of their localities, and it requires no expert to recognize the great superiority of the Canadian mineral.

Mr. L. A. KLEIN pointed out that the only objection to Italian asbestos was that it did not stand spinning so well. He thought that Mr. Donald's sample could hardly be characterized as a fair specimen.

Mr. W. H. IRWIN pointed out that to-day Canadian asbestos is used in every country in Europe for manufacturing purposes, even at the pit's mouth of the Italian mines. As Mr. Donald has explained, there is very little difference between the Canadian and Italian asbestos as to their composition, but there is a very great difference in their formation. The Italian asbestos is exceedingly long in fibre, but it is in such a shape that it is almost impossible to handle it properly with machinery, while Canadian asbestos costs so much less to manipulate, and allows it to be placed in the market in its manufactured shape at a price that will enable it to compete with any other asbestos material.

Mr. A. M. EVANS inquired whether the formation of asbestos actually rises with the contour of the ground or whether it assumes its own level. He knew for a fact that on a level with Black Lake they had asbestos, and that 750 feet above, at Mr. Klein's place, they also had asbestos, and he asked whether Mr. Klein would be right in supposing that he had 750 feet of asbestos. This is a question for mining men in the future to take up.

Mr. B. T. A. BELL asked if it might not be in the interests of the industry to have the occurrence of the mineral tested by the Diamond drill at depth.

Mr. W. H. IRWIN said that as asbestos altered in character every few feet, a bore hole might not be a fair test.

Mr. J. LAINSON-WILLS speaking of the Italian and Canadian asbestos, said he did not know whether the analysis as given by Mr. Donald represented the average composition of these separate minerals. They all knew that they are separate minerals, the Italian being fibrous serpentine, whereas the Canadian is fibrous only. There seems to be too much similarity between the minerals which are really different.

After some further discussion, the Chairman called upon Mr. J. B. Smith, M.E., to read his paper on

Mine Inspection.

Naturally assuming that this paper should deal with the inspection of mines in accordance with the mining laws and regulations of the Province of Quebec, and the recently passed amendments to the Mining Act, I found on consideration of these that they are not mining laws in the proper sense of the term, at least as understood among mining men in Europe, and that it is difficult to anticipate by the light of mining experience merely the effect of enactments which should more properly be considered from a politico-economical point of view.

The recent amendments to the Mining Act referred to concerns itself almost entirely with the sale and purchase or mineral lands and rights, and the imposition of a heavy and direct tax on the produce of all mines, and has for its object so undoubtedly the acquisition of revenue, that I hesitate to speak on the question at all from a miner's point of view, knowing little of the duties of mine inspection under such conditions, and knowing less of the effect of arbitrary laws which invest an inspector—who, from the responsible and delicate nature of his office, ought never to be more than a witness—with power to assess and collect taxes and impose penalties, and, with the summary jurisdiction of a police magistrate, to enforce them.

The tendency in the older mining countries of Europe, especially great Britain, has been of late years towards the reduction, if not total extinction, of royalties, dues, and such impositions, and the appointment of a Government inspector to collect these would, there at least, meet with very determined opposition.

We may, I think, take it for granted on general principles of economy that the less interference there is by the State with a young and promising industry the better for both State and people.

It would be considered monstrous if the Government were to impose a tax on the production of any staple article of food, say wheat for instance, yet a direct tax is levied on the mineral known as phosphate of lime, the sole use of which is for fertilizing the land, and which is the great plant food of the cereal of which bread is made. Is not this a tax on the production of food?

Enormous tracts of land in the Province of Quebec are lying exhausted and unproductive at the present time, actually incapable of growing wheat for want of a fertilizer, and yet a heavy tax is imposed on this mineral, already costly and difficult to mine—a fertilizer capable of reviving the wasted energies of the Province, and enabling her farmers to grow enough corn to supply the wants of a much increased population to say nothing of export.

Perhaps no known industry is so likely to produce general prosperity in a new country as that of mining. It always attracts an energetic and useful population, and the best promise of revenue is to let such an industry develop itself without hindrance and with as little interference as possible.

Colonies rapidly become settled in the neighbourhood of mines, and a demand rapidly springs up for agricultural and other home produce, thus offering the surest guarantee of permanent prosperity to the whole country. Is it a wise policy for a country rich in minerals to hamper this industry with taxes and a complicated system of purchase, and harass those engaged in developing it with the troublesome interference of inspectors and the miserable espionage of informers, the latter of whom will certainly increase in proportion to the penalties of which they are to receive half for their information?

The laws and consequent inspection which are really beneficial to mines and miners, however, are those which control the actual working or operation of mining, and the conditions existing between owners and workmen, in order that the former may not derive profit regardless of the safety and health of the employees, and that the latter may not wrong themselves through the neglect of sanitary laws and the careless indifference to danger engendered by custom and familiarity.

In recent times the object of mining legislation in European countries has been almost entirely in the direction of ameliorating the condition of the workers. By regulating the hours of labor, by preventing the employment of women entirely and children of tender years underground at all, and by the prevention of accidents through the close and regular inspection of underground workings by competent mining engineers; and such inspection has led to other beneficial regulations from time to time.

The passing of the Metalliferous Mines Amendment Act of Great Britain, in 1872, was the result of a great number of Reports made from time to time by the inspectors themselves, showing the inefficiency of the existing laws to insure proper conditions of mining.

The inspectors prior to that time were, as a rule, fairly well educated engineers, though not to compare with the class of mining inspectors of the present day. They were generally practical miners, and men sensible of the high responsibility of their office. In their experience in the general inspection of mines they were brought face to face with a state of things which, at that time, it was not within their power to improve according to existing laws, and I think we have to thank them for the better laws enacted as the result of their reports and recommendations.

The laws, however, which they were indirectly instrumental in making, demanded a much more highly educated class of men to see the regulations enforced, and inaugurated a new epoch in the history of mining in Great Britain.

These Government inspectorships of mining divisions under the new Act were very properly lucrative and honorable appointments; young mining engineers were specially educated at the French, German and English mining schools with a view to obtaining them; many of them had actual experience in the working of mines in several of these countries.

The result of this was to raise the standard of mine engineering in Great Britain in a marked degree. By the light and application of scientific knowledge to mining it has become a more certain and regular pursuit. A mining inspector of the present day is at once an engineer, a geologist, chemist and mineralogist. The competitive examination system in England, insures the selection of the very best men of their class. Their knowledge is communicated to mine managers and in a great measure to the workmen by advice tendered in the intercourse which their close and frequent inspection necessitates. The visit of the inspector is rather hailed with pleasure than otherwise, and under this judicious system inspection cannot be considered domiciliary or in the light of espionage.

The owners of mines feel that useful regulations and close inspection secure a good system of mining, and relieves them of much responsibility.

The manager or agent feels himself also relieved of much personal responsibility in the case of unavoidable accidents.

The penalties imposed for violation of the laws are frequently applied to the relief of the sufferers of mine accidents.

In Canadian mines, perhaps more than anywhere else, mining inspection is urgently needed, not in the sense understood with regard to the recent mining law of Quebec, but for the proper working of its minerals and the prevention of accidents to the workmen.

In this paper I am not referring to coal mines, which usually need special regulations and special supervision, but to such mines and quarries as come under the provisions of metalliferous mining laws.

The sudden changes in such a climate from severe frost, where masses of loose rock and dangerous ground may be held together safely enough in winter, and break away with disastrous consequences in summer, necessitate careful timbering. It is evident that if this is left to the option of the owners or agents the question of safety will, in a great measure, be subservient to that of economy.

In order to see that mining operations are properly carried out, underground surveys should be made compulsory after a certain stage of development, and the duty of the inspector should be to see that such surveys are completed and filled in up to a fairly recent date, showing the addition to such plans of the latest workings. Such surveys are necessary also to prevent the encroachment of neighboring mines on each other's property, and for this purpose should have reference to a surface survey of the country, which should be made by the usual sworn surveyors. Copies of such survey should be deposited at the Record Office of the Province, together with other information supplied by the inspectors. Such records afford valuable assistance to subsequent mining and to the geologists of the country.

The storage of explosives on or about a mine should also come under the authority of the inspector of mines, as well as the quantity allowed to be carried into the mine for immediate use by workmen.

With respect to magazines for storage of explosives considerable latitude should be given in a country but unequally settled like Canada. The expensive magazine needed in a thickly populated neighborhood would be superfluous for a new mine opened in a district which is unsettled and but sparsely inhabited. It should not be overlooked either that great difference of opinion exists among scientific experts on this subject of magazines, and that whilst some recommend costly and elaborate buildings, heavily built and ponderous, others advise the lightest and most fragile of structures, and it is certain that in the event of a magazine explosion the result would be much more dangerous in the former than the latter.

Special rules and supervision are desirable too with regard to the charging and firing of blast holes, having particular reference to the kind of explosive material used.

Also for the securing safe means of ascent or descent of persons in the mines by ladders, and the angle at which they should be placed, with proper provision for resting at convenient stages where the mines are deep.

To secure the good health of the workmen it should be incumbent on the owners of mines to provide a proper system of ventilation, the noxious fumes of after-damp being the insiduous cause of many terrible diseases.

I do not purpose in this paper to supply a code of rules for the working of mines in this Province, and have merely given the foregoing as examples of such a code as could be usefully formulated to the advantage of both owners and employees in this country.

And in all mining countries the owner or agent of mining works should have a right to establish special rules, which may be desirable for the conduct and guidance of the persons employed, after submitting the same to the inspector of his division for approval and the consent of his department.

In conclusion it may be worth while to notice that in older mining countries arbitrary powers to fine and imprison without appeal are never given to inspectors—a system which it is evident, whenever employed, will lead to bribery and corruption.

In England the inspector is never invested with the powers of a justice of the peace—his duty being to report any violation of the mining laws, and prosecute if necessary.

In cases of arbitration, having regard to a dispute as to the violation of the rules, or as to whether it is a violation, the inspector of mines should be considered as one party to the arbitration and the mine owner or agent as the other, and an umpire should be decided on in the ordinary manner.

In England the cases of prosecution are taken by the inspector before a magistrate of quarter-sessions.

I regret that I have not had time to do greater justice to this subject as it is a very interesting one to me.

Its consideration has, however, suggested many things in connection with Canadian mining laws and inspection, which I hope to be able to refer to again at some future time.

Meantime if anything I have said leads to a discussion amongst the many eminent mining men present here to-day the best object of such a paper will be fulfilled.

Mr. W. H. IRWIN, in referring to Mr. Smith's paper, thought it to be greatly in the interest of the mine-owner to have proper mine inspection. In the asbestos district they had an inspector well acquainted with the wants of the community, and although not a scientific or practical miner, thoroughly honorable and trustworthy. He referred to Mr. John White.

The CHAIRMAN: It was undoubtedly a great advantage to know that they were working under the inspection and sanction of a man who thoroughly understood mining work. In the event of any accident the mine operator needs a competent witness in the inspector to bring before the court.

Mr. B. T. A. BELL: It is a notorious fact that in this Province no official record is kept of accidents and no enquiry or report is made regarding them by the present so-called Mining Service of the Government. During the past year there had been falls of roof and slides in different parts of the country, fortunately without loss of life, the mishaps having occurred when the men were out of the pits. It was the duty of the inspector to have examined and condemned these workings. The protection of the employee was the best safeguard to the employer. He thought the Association would be remiss in its duty if it did not make some representation to the Government on the subject.

Mr. A. M. EVANS: In England, in 1862, for every 12,000 tons of coal raised they would kill a man, and after the Government took over the matter in 1870 40,000 tons were raised without any fatality. If the record of that country be taken to-day, as compared with 1870, he believed that the district of Lancashire can produce 50,000 tons without any death from accident. Such was not the case before Government inspection was introduced.

Mr. A. W. STEVENSON thought the subject one of urgent importance, and he would move, "That the President, Mr. L. A. Klein, Mr. S. P. Franchot and the Secretary, be a deputation to confer with the Government on the subject."—Carried.

Visit to McGill University.

At the invitation of the Edison Electric Company, the members took carriages and drove to McGill University Grounds, where a Marvin Electric Percussion Drill and the necessary plant had been installed. Before explaining the plant, the party adjourned to one of the lecture rooms to listen to the papers on the application of electricity to mining operations. The first subject was:—

The Electrical Transmission and Conversion of Energy for Mining Operations.

By H. Ward Leonard.

The transmission and conversion of energy is above all others the question of importance in every kind of engineering work, and in mining engineering this is most conspicuously true.

Until quite recently all practical methods of transmitting and converting energy involved the actual transfer of sensible matter over the distance in question and this matter necessarily possessed such qualities as weight, magnitude, temperature, inertia, and other qualities common to all matter.

It is, therefore, not surprising that all engineers, and particularly mining engineers, are watching with the keenest interest, the development of methods for transmitting and converting energy by means of electricity, for, in electrical problems, the many considerations and restrictions due to the inflexible characteristics of matter may be entirely disregarded and the possibilities of mining engineering are correspondingly increased.

The transmission and conversion of energy by water, steam, cables, compressed air, and so forth, we are all familiar with, and we know to our sorrow the limited distance, the low efficiency or the tremendous first cost which has hampered our engineering work at every turn.

With the utilization of electricity for the transmission and conversion of energy we absolutely reverse these conditions and are enabled to operate at practically unlimited distances with extremely high efficiency and very low first cost.

The invention of the incandescent lamp marks the commencement of an era upon whose threshold we now stand and in which the possibilities of engineering will be extended to a degree we can, at present, have no adequate conception of. Until the Edison lamp was invented and introduced, all distribution of electrical energy was by what is known as the series system, which did not lend itself readily to the development and use of electric motors. With the Edison lamp came the system of distribution on the multiple arc plan and the commercial possibility and development of electric motors dates from that time.

The stationary electric motor, supplied from the lighting circuit, was naturally the first on account of the number and simplicity of its applications; then the motor was applied to propelling street cars, and the modern electrical street railway system was rapidly evolved. The electrical engineer, in his search for "new worlds to conquer," next turned his attention to the mining field.

The great variety of the applications in this field, the distance from the mines to the principal cities, where electrical developments have been most rapid, and the lack of knowledge as to the exact requirements have, until recently, made even the simplest applications of electricity to mining rather rare.

Perhaps the greatest stumbling block has been the percussion drill. Until recently, when a mine owner asked if we could transmit his power, light his mine, and operate his pumps, hoists, tramways and mills, we would confidently reply "Yes!" But when he asked if we could replace or operate his air-drills we were obliged to say, "Not yet."

Since the drill is the most universal of all mining appliances operated by power other than hand power, it was not possible to make rapid progress until this deficiency was corrected.

The Edison General Electric Company has put upon the market in commercial form, during the past thirty days, three types of electrical drills which will enable the mining engineer to accomplish all that he has been able to accomplish heretofore by other drills, and not only this, but to accomplish far more than was heretofore possible and under conditions heretofore prohibitory.

First in importance comes the Electric Percussion Drill, the invention of H. N. Marvin, of Syracuse.

Following is a brief description of the principal features of this drill:—

Fastened upon a suitable tripod or column is a piece of boiler tube, seven inches in diameter and about two and a half feet long. In the forward half of this casing are placed 2 cylindrical coils of wire in the form of solenoids, each about $8\frac{1}{2}$ inches long, having an outside diameter of about $6\frac{3}{4}$ inches, so as to make a loose fit with the casing, and an inside diameter of about $2\frac{1}{8}$ inches. These two solenoids are placed so as to be against each other end to end in the casing. The bit plunger plays freely through the centre of these solenoids and is supported by two bearings placed just beyond the outside ends of the two solenoids respectively.

The back portion of the casing contains a spiral spring of the form frequently used for car springs. The plunger is composed of a central portion made of wrought iron about fourteen inches long, and both the forward and back portion of the plunger, which are made of aluminium bronze, are rigidly fastened to this iron portion. The forward portion is about thirteen inches long and carries the bit socket. The back portion is spirally milled for a length of about 9 inches so that the cross section of this portion is hexagonal. At the extreme back end is a steel buffer which strikes against the cushioning spring.

The spirally-milled portion of the plunger is similar to that used in other percussion drills, and causes the drill to revolve upon its axis ⅙ of a complete turn with each stroke. The ends of the coils of wire are brought to contact pieces at the top of the adjacent ends of the two solenoids, where there is a socket for receiving the terminals of the cable, and thus making electrical connection with the drill. There are three conductors leading from the generator to the drill, one of which is connected to one terminal of each of the solenoids, and the other two conductors are connected to the two remaining terminals of the solenoids respectively.

The generator is of the simplest kind, the coils on the armature having their terminals connected to two insulated collars on the shaft.

One collar is a continuous metallic ring, and upon this one rests a brush which is connected with the conductor, which is common to both solenoids. The other collar is metallic for half of the circle, and the remaining half is insulated from the armature wires. Upon this half ring rest two brushes diametrically opposite each other and each brush is connected to one of the two remaining conductors leading to the solenoids in the drill.

If now we revolve the armature of our generator in a separately excited magnetic field, an electric current will flow, let us say, from the armature to the half ring, then through one of the two brushes which happens at the instant to be in contact with the half ring, along the corresponding conductor to one terminal of one solenoid, let us suppose the rear one; then through the rear solenoid itself, and back along the mutual wire to the continuous ring and then to the armature again.

This current, in passing through the rear solenoid, makes a powerful magnet of it, and this tends to pull the plunger back into a position such that the centre of its iron portion shall be in the centre of the rear solenoid.

When the armature moves forward a half revolution the polarity of its wires is reversed, and the other brush, with its conductor, is now in contact with the half circle; consequently, the current in the mutual wire will be in the reverse direction from that of the former wave; the rear solenoid and its conductor, formerly active, are now out of circuit, and the circuit is made through the other conductor and its corresponding solenoid, that is, the forward solenoid.

The magnetic action of this solenoid tends to make the plunger move forward, so that the centre of the iron portion shall be in the centre of the forward solenoid.

Thus we get a reciprocating action of the plunger, and every revolution of the armature of the generator will cause a complete stroke of the drill. By varying the speed of revolution of the generator we can make the drill strike any number of blows per minute we choose. In usual practice 600 blows per minute are found to give excellent results. The spiral spring, it will be observed, stores up the energy of the back stroke and returns it to the forward stroke, assisting the magnetic impulse and greatly increasing the strength of the blow.

In order that we may form an unbiassed judgment of this drill, I will quote the opinion of André, perhaps the best authority on power drills, who, many years ago, stated the requirements of a first-class power drill to be as follows:—

1. Simple in construction, strong in every part.
2. Few parts, especially moving parts.
3. As light in weight as can be made strong.
4. Take up little space.
5. Striking part of relatively great weight, and strike directly.
6. Piston alone exposed to shocks.
7. Piston capable of variable length of stroke.
8. Sudden removal of resistance should not injure any part.
9. The rotary motion should be automatic.
10. The feed of machine, if automatic, should be regulated by the advance of the piston as the cutting advances.
11. Should be capable of working with moderate pressure.
12. Should be readily taken to pieces.

It may be sufficient to say that the Marvin drill possesses every one of the good qualities André specifies, and in a most marked degree; but, in describing the good qualities of this drill, we can, if necessary, add considerably more than André specifies. For example:—

1. It is simple in construction and strong in every part.
2. It has a minimum of moving parts, that is, one.
3. It is very light in weight, for its strength—this being possible because of the perfect cushioning at both ends of the stroke.
4. It takes up very little space.
5. The striking part is of relatively great weight, and strikes directly.
6. The length of stroke is variable at will.
7. The drill cannot damage itself by its own blow.
8. The rotary motion is automatic
9. It has very few parts.
10. It can be entirely taken apart and put together again inside of ten minutes.
11. There are no joints to be fitted or packed.
12. It is not affected by heat or cold.
13. It can be operated at great distances from the source of power.
14. It has a much higher efficiency than other drills.
15. It is independent of the action of any valve.
16. The rate of striking is independent of the kind of material it strikes.
17. It will operate in the open air without striking anything, and hence can be made to strike an extremely light blow at its full rate, which is very important in starting holes, and so forth.
18. It can be rapidly moved from one position to another at a great distance, since the energy is transmitted through flexible cables.
19. No loss is suffered due to elbows, bends, valves, etc., in the conductors.
20. The conductors can be carried on very light supports, both because of their light weight and because the transmission of energy through them does not tend to distort their position.

The importance of the above characteristics will be apparent to any one who is familiar with the operation of the steam and air drills.

It is interesting to note that in driving the Hoosac Tunnel the average life of the power drills, before sending them to the shop, was fifty hours. Even to-day, after a development of twenty-five years, we find that it is common practice to have in the shop one-half the total number of drills employed.

In pushing engineering work it is frequently of paramount importance that the work be done quickly. Therefore, any means of greatly increasing the rate of drilling is extremely valuable. To increase the rate of drilling we must either increase the strength of each blow or else we must increase the number of blows per minute. A limit to the rate of striking is soon reached when a valve of considerable weight must be moved from rest by the concussion of the previous blow, and when a material substance, such as air or steam, must then fill the space back of the piston and raise the pressure to the working pressure. Also the strains and shocks caused by the valve and the air or steam soon become troublesome as we increase the rate of striking. With the Electric Drill the speed of rotation of a perfectly balanced cylindrical armature of small diameter alone determines the rate of striking, and there is apparently no limit to the rate of striking, except the possible rate of the magnetizing and demagnetising of iron, which is already done in daily commercial practice at the rate of 10,000 times per minute with the highest efficiency.

With 800 blows per minute we have already drilled at the rate of four inches per minute a hole 1½ inches in diameter in the hardest Quincy granite, and that with an expenditure of energy not exceeding three horse power.

I firmly believe that in a comparatively short time we will be furnishing percussion drills whose rate of striking will be several times as much as that we now employ, and that with no more and no heavier drills than are now used the rate of driving a heading will be increased many times. The importance of rapid driving of work is practically illustrated by the fact that in the Sutro tunnel, Mr. Sutro offered the men at work, in addition to their regular wages, the following bonus:

For every foot per month over 300 and under 400, $5.
" " " 400 " 500, $10.
" " " 500 $20.

A bulletin from the Census Department, under date of March of this year, shows that in granite quarrying the cost of labor is 84% of the total cost of production, and in Massachusetts, where the output is much greater than in any other state, and where the longest experience and most approved methods are met with, the labor is 82½% of the total cost. It will be evident that any labor-saving device in such a field will be extremely valuable.

Another drill of great value to the mining engineer is the Diamond drill. The Edison General Electric Company have, during the past thirty days, put upon the market an electric diamond drill which they have been developing for the past two years. The drill is the invention of J. E. Storey, of Denver. It presents a great many advantages over the diamond drills heretofore used, as will be evident from the following description of it:—

The drill weighs complete 239 pounds. The average power consumed is about 1¾ H.P., and with this expenditure of power the drill will bore a hole of 1¼ inches diameter in hard rock at the rate of two inches per minute, taking out a core of ¾ of an inch. The drill rod is rotated at the rate of 400 revolutions per minute without any load, and when drilling at full load the speed is practically the same.

The drill rod is geared by a single set of gears to an electric motor which revolves at 1,600 revolutions under conditions of full load. The motor has four poles, and the keeper joining the poles is in the shape of a surrounding cylindrical shell, which thoroughly protects all the parts of the motor and other parts of the machine.

Upon the drill rod is placed a rotary pump which supplies the drill with the necessary water.

In using the diamond drill the following points are of great importance:

1. The speed should be uniform and automatically controlled very closely, so that removing the load quickly will not permit the drill to run away.

2. The drill should run at as high a rate of speed as is consistent with smooth drilling and a proper supply of water.

3. The drill should be extremely steady, as any material vibration transmitted by the drill rod to the diamond points is disastrous to them.

4. The drill should be as light and compact as is consistent with the requisite strength.

5. The drill should be capable of being readily and rapidly moved considerable distances and put into operation again with the least loss of time.

Up to the present time diamond drills are operated by reciprocating engines, and the engine is fastened upon the same frame as the drill rod, to which it is geared by suitable gearing. The engine usually has two cylinders of the oscillating type to reduce the vibration as much as possible, and eliminate the dead points. With these small engines it is practically impossible to automatically get the close regulation of speed which is desirable, and the speed is governed entirely by hand throttling. The engines cannot be run at very high speeds because of the vibration they would produce, and because of the rapid depreciation of such engines at high speeds. It, therefore, becomes necessary to gear to the drill rod by gearing, which is oftentimes objectionably large, and would become even more so if a higher speed upon the drill rod were attempted, as is desirable. The space occupied by the drilling machine is quite large, as the engine, gears, etc., occupy much space. This is a great objection in cases of operation in tunnels, shafts, etc.

With the electric drill the motion is free from any jar, as there are no reciprocating parts, and the speed can be made absolutely constant under any condition of load up to full load. The speed of the drill rod can be made anything desired up to several thousand revolutions per minute, if desired, and under any conditions of speed above 1,600 per minute there would be no gears whatever. The weight of the electric diamond drill is, for the same power, much less than that of the steam diamond drill, and the space occupied is in a direct line with the hole, and is extremely small in amount.

The drill can be operated from any existing electric light circuit, and the current for it can be supplied at two miles' distance from the source of power by wires of size No. 10 B.W.G., having a diameter of about ⅛ of an inch. The drill can be carried wherever a man can carry 35 pounds, which is the weight of the heaviest single part, and hence can be quickly set up and operated in the most inaccessible places.

It will be evident that for prospecting work, when a certain territory is to be explored, this drill is particularly adapted.

Starting from a convenient and economical source of power, we can, if desirable, lay our wires along the surface of the ground, and in a very few hours can be operating our drill miles off. We can then reel up our wire and lay it again in an exactly opposite direction, and again be in operation at perhaps five or ten miles off in the course of a few hours more. In laying the wire, a couple of horses yoked abreast, and carrying the reel, is all that is necessary. For operating at a distance of one mile in any direction, the diameter of the wire necessary is but $\frac{1}{10}$ of an inch, and the total weight of the wire only 340 lbs.

The facility with which prospecting, and also drilling, in permanent works such as mines, can be done with this drill, will no doubt lead to its rapid and general use.

There is every reason to expect that with the electric diamond drill the speed of the rotation of the drill can be very greatly increased, with consequent increase in the rate of drilling, which is of the greatest importance.

The Edison General Electric Company have a third kind of drill, which is a rotary high speed drill, having a solid steel bit, and this drill is used for drilling coal and similar comparatively soft materials, and also for drilling metals, where it will have an extensive use in the construction of steel ships and bridges, and similar works where the drill has to be taken to the work rather than the reverse.

With the three drills which I have described, the Edison Company is now able to do any class of drilling desired, and these drills are likely to play an important part in the future of mining engineering.

The electric mine locomotive and the hoists, pumps, ventilating fans, crushes, stamps, etc., operated by electricity, are instances of the application of electricity to mining which have already proved themselves entirely successful. The undercutting of coal by electricity is an important field in which the Edison Company has made great strides, the machines being of two entirely distinct types, which become necessary in order to properly comply with the conditions met with in practice in different mines.

The electric refining of metals, especially of copper, is an extremely interesting subject to the mining engineer. The Edison Company have established the majority of the plants of this nature in the United States, and I need only say that the results are highly economical and most satisfactory in every way.

The electrical transmission and conversion of energy at great distances is destined to come up in nearly every mining problem in the future. Mines are usually in a mountainous country, and it is seldom that a water power cannot be found within a few miles of a mine. The mining engineer in the immediate future will, to develop this water power, convert its energy into electric energy, in which shape he will transmit it to the distant mine, when it will be again converted into the various forms of energy which he may have occasion to require.

Among the applications will be the following:

1. The lighting of the mines and the buildings and grounds by arc and incandescent lamps.
2. The operation of any machinery in the mill, such as crushers, stamps, etc.
3. The operation of the drills.
4. The operation of the hoists.
5. The operation of the pumps.
6. The operation of an electric tramway in the mine.
7. The operation of ventilating fans.

8. The heating of the buildings when fuel is scarce.

9. The refining of copper and recovery of gold and silver in certain cases.

10. The concentration of magnetic ores in certain cases, such as iron, nickel, etc.

In order to give to you a commercial idea of a plant such as is likely to be used in mining operations in the immediate future, I will suppose a case and give you an estimate of the first cost and operating expenses of such a plant. Let us suppose that we have a mine where we have to operate the following devices:—

360 incandescent lamps of 16 candle power each.
10 arc lights.
1 hoist requiring 30 horse power.
1 pump requiring 20 horse power.

6 percussion drills for drilling 1½ inch holes at the rate of three inches per minute.

2 rotary diamond drills 1¼" hole, ¾" core, rate 2 inches per minute.

1 mine locomotive 10 horse power.

Milling machinery requiring 30 horse power.

Heating requiring 10 horse power.

The total power required for the above will be 180 horse power delivered by the main motors. Suppose that at a distance of three miles there is a good water power which can be developed and equipped with water wheels to produce 300 horse power by an expenditure of $15,000. In considering transmission of the power by electricity, we must first determine what loss we shall sustain in transmission, and then we must determine what electrical pressure we will operate with.

In designing such a plant, there are certain fixed laws governing the conditions of highest economy and minimum first cost, and some years ago I investigated these questions and deduced formulæ expressing these laws.

It may be interesting to note here, in passing, a fact which you will observe by examining the formulæ given, namely: If we pay proper attention to the laws governing the highest efficiency and least first cost, the cost of the conductors for the plant will be independent of distance and will depend solely upon the percentage of loss we decide to sustain in the conductors. Thus, under practical conditions to-day, if we are to operate at 15% loss we should employ a pressure such that, at the distance in question, the cost of copper for each horse-power delivered at the motor brushes would be $7.47. Similarly the cost of copper per horse-power corresponding to 20% loss would be $11.20 and that corresponding to 25% would be $16.00. This simple but invariable law, which is embodied in the formulæ given herewith, you will find of great assistance to you in considering questions of electrical transmission.

You will also notice that the formulæ show that the electrical pressure to be employed will vary directly with the distance. Thus, for 20% loss, the cost of copper being $11.20 per horse-power delivered at motor brushes, the e.m.f. necessary for transmission of 16,000 ft. will be 1,500 volts; at 32,000 ft. we should use 3,000 volts, and at 8,000 ft. 750 volts.

Suppose that after investigating the question of the value of the original power we find that a loss of 25% in the conductors will make the value of the power wasted in the conductors per year just equal to the interest on the investment made necessary by the power wasted in the conductors. This loss will then be the most economical to operate at, according to Sir Wm. Thompson's well known law. Now, by reference to the curves on sheet No. 2, we find that to operate at a distance of three miles with 25% loss, the minimum of first cost will be realized when we operate with an initial electrical pressure of 1,200 volts.

In order to secure the 180 horse power necessary at our various devices in and about the mine, we must deliver 200 horse power to our main motor in the form of electric energy in the conductor at the brushes of the motor. With 25% loss in conductors this will mean 266 horse power at the generator brushes or 300 horse power delivered by the water wheels.

For the sake of reliability and economy we will use two generators instead of one, each being of 133 horse power. At the mine there will be two main motors of 90 horse power each, wound for 900 volts and 83 amperes, producing a total of 180 horse power which will drive the drill generator of 17 horse power and a generator of 250 volts and 300 amperes for operating the incandescent lamps, the arc lamps, the mine locomotive, the hoist, the pump, the diamond drills and the heating. The main motors will also supply the milling machinery with the necessary 30 horse power.

By formulæ on sheet No. 1, we find that to transmit 180 horse power three miles with 25% loss and an initial pressure of 1,200 volts there will be required a wire having a circular millage of 190,000 circular mils; this is having a diameter of 436 thousandths of an inch, or a little less than half an inch.

We find by other formulæ on sheet No. 1 that the copper will weigh 20,000 lbs. and will cost $4,000, which results check each other and prove the accuracy of the calculation.

We are now able to make an estimate for the total plant, as follows:

Estimate of cost of plant for transmitting 180 H.P. a distance of three miles, with a loss of 25% in conductors, the plant to comprise the apparatus as specified.

Developing original water-power and installing water-wheels of 300 H.P.	$15,000
2 Generators, 100 K.W. each (1200 v.—83 amp. each), @ $36 per K.W.	7,200
2 Motors, 75 K.W. each (900 v.—83 amp.), @ $36 per K.W.	5,400
Copper, 32,000 ft., No. 000, B. W. G.	4,000
1 Six-drill Generator.	2,000
1 Generator of 250 v.—300 amp., 75 K.W., @ $36	2,700
6 Electric Percussion Drills	3,300
2 Electric Diamond Drills	1,100
360 Incandescent Lamps and appliances.. ...	360
10 Arc Lamps	220
1 30-K.W. Hoist	2,255
1 20-K.W. Pump	1,595
1 10-K.W. Locomotive	1,815
Heaters—10 K.W.	600
Conductors for all secondary transmissions..	1,000
Labor of Installation	3,000
Poles	455
Freight, Cartage and Sundry Expenses.....	1,000
Total	$53,000

The operating expenses of such a plant will be those mainly due to the wages of two men for each shaft—one at the water-power and one at the mine.

A fair allowance for depreciation and repairs will be 5% per annum of the first cost.

The operating expenses will therefore be about as follows:

1 First Operator, per year	$900
1 Second Operator, per year.	600
Depreciation and Repairs, 5% on $53,000	2,650
Sundry Incidental Expenses	250
	$4,400

The production of the same power by steam, when coal is $2 per ton, and labor such that an engineer's wages are $2 per day, would not be less than double this amount; and in many instances, where water and fuel, suitable for the generation of steam, are difficult to obtain, such a plant would represent a saving of its entire first cost every year.

NEW YORK, April 28th, 1891.

THE CHAIRMAN then called upon Mr. J. W. Kirkland, Boston, who continued the subject in a paper entitled:—

Recent Developments in Electric Mining Apparatus.

MR. PRESIDENT AND GENTLEMEN:—No other section of this continent offers such exceptional and striking facilities for the introduction of electricity as does this great Province of Quebec. Nature has been bounteous in her distribution of water, and your hills have by their ruggedness forbidden these masses of water from pursuing a slow and unbroken course to the sea. In travelling through your country the visitor from the States is impressed by the fact that there is hardly a town, hardly a mine, hardly a factory, which is not almost within hailing distance of some river or torrent which has for ages been expending its kinetic energy in re-arranging its channel and cutting away the rock over which it flows. These waterfalls are destined to become the great agency for opening your mines and driving your mills and for transporting their joint products. So much for the water facilities; but we may still go further in congratulating you upon your possessions of cheap power. Even where water power is not at hand you are still more advantageously situated than are your neighbors—with your great woodlands waiting to be cleared in order that better things may be planted, and in the clearing supplying cheap fuel for your boiler fires.

In connection with the development which is bound to spring from these great natural bequests, one fact is assured; one powerful agent, electricity, must play an important part. The strides in its application have been tremendous in the last few years; the prophet who will not foretell still greater ones to come is faint-hearted indeed.

An electric mining equipment consists of three elements, each to be considered separately and each forming a distinct part of the problem to be solved. They are: the generating plant, the line, and the motor or other device for utilizing the current. The generating plant which comes first, from its very nature, differs but little from electric lighting installations, already so common, the dynamo electric machines having, however, rather a different form. The measuring and productive devices consist of the usual ground and potential indicators, the lightning arresters, the hand switch and the automatic cut-outs, the desirable position of which and the method of connection are often prescribed by underwriters' rules. The generators are, as a rule, wound for an electric potential of 220 volts, this seemingly odd quantity having become one of the standard units of electric pressure by reason of the fact that the incandescent lamp is conveniently made for a pressure of 110 volts, so that upon 220 volts two incandescent lamps may be run in series. The pressure chosen is one which is perfectly harmless to either human or animal life. It admits of very perfect insulation in the underground chambers of mines, which are, as a rule, impregnated with moisture which is always seeking to form a by-path for the electric current. The generating station requires primarily a source of power, whether of water or steam, and its position with reference to the mine is therefore determined principally by the condition of obtaining power cheaply and conveniently. It may be several miles from the mine or quarry, it may be in the quarry, or again it may be at the bottom of the mining shaft, as is the case in a somewhat celebrated plant in the Comstock Lode.

The line is so simple a feature as to require no description. You have your poles close at hand, generally needing but a few strokes of the woodsman's axe to prepare them for their work; your wire and supplies you can buy cheaply right here in Canada.

Having brought your power to the mine, the ways in which you can dispose of it are almost without limit; with it you may displace your ponderous steam pump, your costly air-compressor, your steaming, sweating, and worse still, short-lived mules; and last, but not least, your dangerous miner's lamp. With it you can ventilate the most remote corner of your workings, and the shaft which has previously been useless because mother nature has chosen it as an artery for her watery blood becomes, by the introduction of an electric pump, a dividend-paying property.

But I will come to my real purpose in reading this paper to-night. That is, to bring before you some of the specific methods in which this invisible agent is to be made use of.

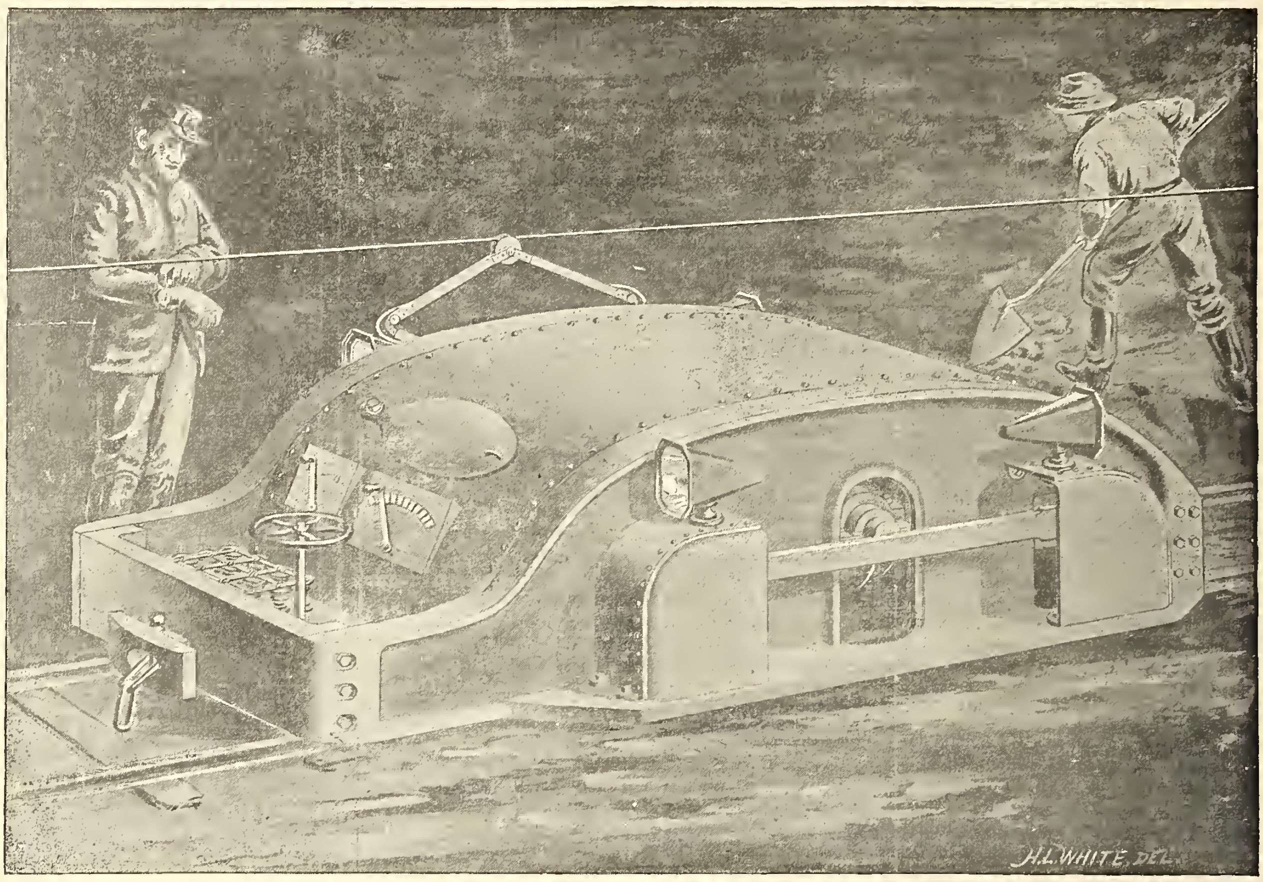
As we have had the pleasure of listening to a very interesting talk by Mr. Leonard on the subject of electric rock drills it will not be necessary for us to deal very fully with that part of the subject, and I will confine myself to a few brief words, merely calling your attention to the form of drill invented by Mr. Chas. J. Van Depoele and manufactured by the Thomson-Van Depoele Electric Mining Co. This photograph shows the drill as it appeared in a practical test made upon it at the quarry of the Cape Ann Granite Co., Cape Ann, Massachusetts, a few months ago. To bring this photograph nearer to each of the members we have had prepared these prints, with which I hope all by this time are provided. The rock drill which is represented in the photograph and in the prints has a capacity to open a hole two inches in diameter in the hardest kind of granite that we were able to obtain for the test at the rate of something over 1½" per minute, and this with an expenditure of only about 2½ electrical horse power. The coils and connections, the carriers of the power-giving current, are completely enclosed within a solid iron casing and are simple in the extreme, a quality which should be one of the very first to be sought in designing all mining machinery, whether electrical or otherwise. A cable consisting of three separately insulated conductors of small cross-sections is connected to corresponding terminals in the junction box at the top of the machine, seen near the letter G in the print. This diagram which has been prepared from the patent granted to Mr. Van Depoele on his invention, shows the three wires running from the dynamo D, and the three coils or solenoids within the drill. The central coil is traversed by a current pulsating in intensity but constant in sign or direction, which serves to keep the iron core or piston in what is electrically termed a saturated condition—that is to say, a state of maximum magnetization at all parts of the stroke. It is termed a polarizer, and consists of many turns of small wire. One terminal of this coil is connected to one of the revolving brushes and the other to a stationary one which is in this case the negative. The current, therefore, in this coil varies from 0 to maximum and back again to 0, as the brush A moves from the position in line with the negative brush all round the commutator and back to its original place. Now examining the coincident conditions in the outside coils, first stating that these are wound of few turns of comparatively large wire, and so that if a north pole is at any instant at the inside end of the upper coil marked No. 1, a similar pole finds itself at the corresponding extremity of the coil No. 2.

Now the polarizing coil is energized by a current produced by the difference of potential between the brushes A and *b* equal to one half the voltage of the dynamo—or 110 volts. At this instant the outside coils are neutral because the brushes A and B are at their middle points, and the core is now drawn towards the middle of the drill, lagging behind the magnetism an appreciable amount.

Assuming now that a one quarter turn of the yoke holding the revolving brushes has been made, the middle coil is now getting its maximum current due to the total electro-motive force of the dynamo; the outside coils are also at their maximum, and while one is tending to repel the similarly magnetized core in the direction of the other coil, the latter is itself at the same time exerting an attraction upon the core. Another one quarter turn and the current in the outside coils has waned and disappeared entirely, and the current in the polarizer has also decreased to one half its maximum value. Another one quarter turn and the conditions are the same as those when the brush RC was in line with the positive terminal, except that the direction of current in the two outside solenoids is at present of opposite sign. The core is therefore pulled toward the other extremity of the drill. This action is repeated continuously, the magnetized core always seeking to place its north pole as close as possible to the nearest pole of opposite sign, that is, it tends to embrace at each instant the greatest possible number of lines of force, or in lay terms, magnetism.

From the above I hope that those of you who have not neglected your electrical education will see why the core is kept vibrating, making one stroke up and down for each complete revolution of the revolving brushes. The length of the stroke depends upon the rate of pulsation and upon the distance of the drill from the rock it is cutting.

This diagram, by the way, represents an electric generator in the usual conventional method which is probably familiar to some of you. The motion is imparted to the revolving brushes by means of a small intermediate shaft, belted to a sliding yoke which revolves close to the commutator and carries brush-holders at its two opposite extremities. It may be well to state that an automatic device consisting of a steep pitched screw and nut gives the drill a turn of ⅛ of a revolution at every stroke, thus insuring a clean-cut round hole. I leave you to judge of the compactness and solidity of the drill and its tripod from the prints. The same form is at present made in three sizes, of which the one represented is the largest. These drills are also, when required, placed upon quarry bars for mine and tunnel work.


H.L.WHITE, DEL.

Before leaving reciprocating apparatus entirely, it will be well to touch upon a machine similar in principle to the drill, viz., the reciprocating pump, in which the power end resembles in outward appearance the corresponding end of a steam pipe, but which, instead of containing a carefully turned cylinder with close fitting piston and steam valves and joints, contains essentially the same arrangement of solenoids as I have described in connection with the rock drill. The pump is light and compact and lends itself readily to use in sinking shafts where space is of much importance, and where it is necessary to suspend the pump vertically and lower it by means of chains as the work progresses. A pump of this kind having a water cylinder of 4 x 8″, built by the Knowles Pump Co., Warren, Mass., is now on its way to Frankfurt, Germany, for the great electrical exhibition to be held there during the coming summer. The results obtained from its tests may be of interest. I quote directly from the report of the expert in charge :—

KNOWLES' PUMP.

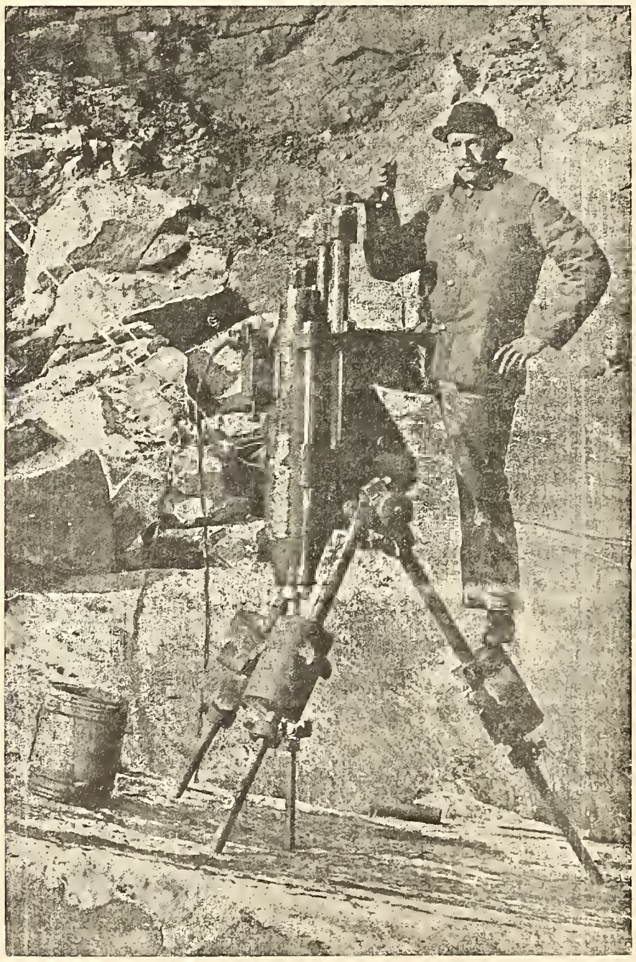
Weight complete on base, about......	800 lbs.
Weight of motor end................	400 "
Strokes per minute................	120 "
H.P. consumed, about..............	2½ or 3
Gallons raised per minute..........	50
Head..........................	100 feet

Remarks :—The water piston was so tight that it could not be moved by hand, so that a good deal of power was thus absorbed. After a day or two of continuous working this difficulty will be removed.

Passing now from electrical apparatus in which the magnetic attraction is exerted to produce rectilinear motion, let us turn to those in which the electric motor in its usual form delivers its energy by a rotary motion.

Mine traction is one of the first problems to be solved, and happily it is one to which electricity is peculiarly well adapted. This photograph and one of the prints which you have represents a new design of mining locomotive, capable of doing work at the rate of 60 h.p. This machine is being built for the Blossburg Coal Co., operating the Bear Run mine in Pennsylvania. Another of the same size is under construction for the Hillside Coal and Iron Co., another of 40 h.p. is to go to Schofield, Utah, and a fourth of 25 h.p. to the Livingstone Coal and Coke Co., Livingstone, Montana.

As will be seen, the mechanism is enclosed completely in an iron covering which prevents the admission of water and protects the moving parts from injury which might be caused by falling rock or careless workmen.



This machine weighs, complete, about 21,000 lbs.; it has an estimated traction of 2,000 lbs., at 10 miles per hour, and will haul a load of 85 tons at a speed of 10 miles per hour on a level. Its height over all is only 40 inches and its gauge is 36 inches up. The 60 h.p. motor is carried directly upon the axle of the machine, and is reversible. Its speed and traction are under the immediate control of the driver or motorneer, as he is sometimes called, who is accommodated at one end of the platform with rheostat handle, reversing switch, and powerful brake within easy reach. No single pound of material is wasted in the construction of this machine; the great weight necessary to prevent slipping is usefully disposed of in the frame and platform, and in strengthening all parts. In this respect the new locomotive differs from other types in which the weight is too often supplied by attaching otherwise useless masses of iron to the platform.

The same form is preserved throughout all sizes. The method of conveying the current to the locomotive has been often described before and is probably known to a great many of you. Still for those who have not followed electric traction very closely it will, perhaps, be well to speak a few words upon this subject. At one side of the gangway, placed within a few inches of the roof, a bare hard drawn copper wire is supported by means of especially designed mining insulators, which are, in turn, fastened either to the timbers or, if the roof is good, directly to the latter. A trolley arm of rather ingenious design maintains a gun-metal wheel in close contact with its bare wire and preserves an even upward pressure, accommodating itself to a considerable variation of the trolley wire.

The current entering the motor from the conductor enclosed in the trolley arm passes through the rheostat, the reversing switch, and the electric motor, and then passes from the wheels of the locomotive to the rails, which are bonded together by copper conductors through which it returns to the electric generator.

A complete line of frogs, switches, crosses, etc., are provided for the overhead wire which guides the trolley wheel in the proper direction.

It is not an unusual occurrence in mines to find steep grades of more or less length, which, if they were to be surmounted by the locomotive would require that it be of large capacity for hauling ordinary loads on level stretches; to do this work by such machines would therefore be uneconomical. How does electricity apply to these cases? I beg to call your attention to the third and last print—that of the electric hoist. By means of this machine a system of tail-rope haulage upon the grades is operated, running from the top to the bottom, and doing the work of a locomotive in raising the cars. The hoist shown consists of an especially designed motor, waterproof in construction, mounted upon one bedplate with a hoisting drum, and geared to it through a friction clutch. This motor is like the one used in the mining locomotive, reversible, and its speed controlled by a rheostat. A strap friction brake is applied by the foot lever shown in the print. This clutch is operated by the hand lever, and the rheostat and reversing switch are manipulated by a third lever. The whole machine is compact and simple having few moving parts and requiring no skilled labor for its operation.

The following are some figures upon the 15 horse power hoist :

Total weight..................... 4,435 lbs.
Speed of motor varying between 700 and 1,200 revolutions per minute.
Speed of winding drum varying between 24 and 41 revolutions per minute.
Efficiency from the energy in the wires to load lifted.................. 60%

When you consider that this figure of efficiency takes into consideration all the mechanical and electrical losses, such as friction of gears and of rope, you will, I think, admit that it is high.

I leave it to you, as practical men, to weigh the electric hoist against the steam hoist with all the small details of piping and valves which the name implies, and I feel certain that the latter will be found wanting.

The electric hoist is moreover a probable successor to the steam winch at the top of the mine shaft, used for raising cars and buckets.

These photographs show a form of electric pump which is quite worthy of mention. The mechanical part is made by the Goulds Mnfg. Co., and the electric motor is one of our standard type, especially prepared to be waterproof. An efficiency of about 70% is obtained from the complete and exhaustive tests made upon the various sizes of these machines.

Still another form of electric pump consists in the adaptation of a motor to a Knowles standard power pump in which the motion of the armature shaft is transformed into a reciprocating motion by means of a set of worm gears and cranks.

We have now touched upon the most prominent features of an ordinary electric mining equipment with the exception of the electric lighting, which is a matter somewhat apart from our subject.

It only remains to be said that incandescent lamps can be placed wherever desired and made to receive their current from the same wires which supply the energy for the motor and devices.

In conclusion, gentlemen, I wish to say that the Thomson-Houston International Electric Co. stands ready to give further information on these subjects upon demand; and I extend to you all in its name, collectively and singly, an invitation to visit the Thomson-Houston factories in Lynn, Mass., whenever you may find yourselves in that part of the country.

After a vote of thanks had been passed to the gentlemen for their interesting papers, the members visited the plant and witnessed the operation of the Marvin electric percussion drill, under direction of Mr. W. M. Schlesinger, the expert of the Edison Company, New York. The experiments, although conducted under much difficulty, sufficiently demonstrated the utility of the drill as a factor in mining and quarry work. The drill was then taken to pieces, and the simplicity of its parts pointed out. The members were well pleased with the demonstration, and many favorable opinions were passed as to its application in the immediate future. We believe that these experiments have already resulted beneficially to the company, several sales being reported.

A Jovial Dinner.

In the evening the first annual dinner of the Association was held in the Ladies' Ordinary of the Windsor Hotel, Montreal. About seventy members and invited guests were present. Hon. George Irvine, Q.C., President of the Association, occupied the chair, having on his right Sir William Dawson, Principal of McGill University, and on his left Mr. R. Archer, President of the Montreal Board of Trade. The vice-chairs were presided over by Mr. S. P. Franchôt, managing director of the Emerald Phosphate Company, Buckingham, and Mr. D. A. Brown, Bell's Asbestos Company, Boston. After an excellent dinner the Secretary intimated letters of apology from the following: Sir Donald Smith, M.P., R. Prefontaine, Q.C., M.P., W. B. Ives, M.P., R. N. Hall, Q.C., Frank Grundy, Manager Quebec Central Railroad; Prof. T. Sterry Hunt, New York; Rev. Abbé Laflamme, Quebec; Hon. F. Langelier, M.P., Quebec; Hon. G. A. Drummond, Montreal; Dr. G. M. Dawson and Dr. R. W. Ells, Ottawa; Mr. J. M. Reid, President Gold Miners' Association of Nova Scotia; T. R. Gue, Halifax; John E. Hardman, S. B., Oldham; A. Blue, Toronto, and others.

"The Queen" having been honored, the chairman proposed the first toast, "Our Province," and called upon Mr. R. Archer, President of the Montreal Board of Trade, to respond.

Mr. ARCHER thanked the Association for extending to him an invitation to be present. He referred to the Mining Act passed by the Quebec Legislature last session, and stated that the Board of Trade of Montreal made every endeavor to frustrate it. He expressed his pleasure in meeting the members of the Association around the festive board, and stated that he would urge the Council of the Board of Trade to assist in giving that protection to mining men which they certainly deserved.

Mr. Ernest C. Arnoldi sang in fine style, "Drill, ye Tarriers, Drill," which was quite an appropriate song, and was well received.

Mr. W. HAMILTON MERRITT, M.E., Toronto, proposed "The Mining Industries of the Province of Quebec." He said: "I am very glad to have the honor of proposing this toast because, as an Ontario man, I feel it a pleasure to be amongst the Quebec mining fraternity and accepting from them their kind hospitality. I am delighted to have the opportunity of meeting personally the mining men of the Province, for I think if there is any branch of industry the world over, where there is good fellowship and a sort of Freemasonry, it is to be found among the mining fraternity. The mining industries in the Province of Quebec are indeed well worth the utmost enthusiasm on the part of Canadians, for in no province has there been such advancement in recent years as in your Province of Quebec. Your asbestos is known the world over, where its manufactures are used; your phosphate has established for itself a celebrity none the less wide, and of course the copper industry in Quebec has been proved to have a permanency about which there is no question whatever. The mining industry is so precarious, and capital so shy, that encouragement and not restriction, or vexatious regulations, should be the policy of every government; therefore, to-day I was surprised in hearing, in the discussion on the Quebec Mining Act, that if a man goes off into the comparative wilds and obtains a mining location, it is necessary for him to pay a license of $150 for the erection of a powder magazine. If this is the case I am sure there would be every justification for what might be termed a very decided "kick" all over the Province against it. I feel that all mining men are proud of the advancement that has been made in mining affairs in Quebec and in Canada generally; but when we realize our position in comparison to that of our neighbors to the south of us, where nearly six hundred million dollars are produced annually, while we produce less than twenty million dollars, I think it will be apparent to all that every assistance should be given us by the Government in bringing the industry to that condition which our mineral resources warrant. We cannot, and do not, expect the government to do prospecting and mining, but I believe that we have a right to request the acquisition and preservation of facts relating to mining and metallurgy, and the creation of an official and authentic reference literature relating thereto. Sir William Dawson touched the very root of what is claimed to be a serious weakness in the present system of the Geological Survey, when he said 'that if the excellent publications of that body were carefully searched through much valuable information relating to mining development can be found.' Now it is contended with reason that while a Geological Survey is necessary, systematic attention and judicious assistance to the mineral and metallurgical interests is an equal, if not a greater, necessity; and if it can be accomplished in no other way the former could be well curtailed to carry out the latter. While Sir William Dawson's able son was in charge of the Survey, we were able to induce the government to establish the Statistical Branch of the Geological Survey. This was a great step, and now we ask that mining and metallurgical information shall be condensed and not merely available in the form Sir William Dawson has indicated. The publications of the United States Geological Survey, edited by Mr. T. Day, is more what mining men desire."

Mr. S. P. FRANCHOT, in responding, referred to the taxation which the Quebec Government has recently imposed upon powder magazines, saying that taxation came as sure as death, but that he had not heard of royalties in this connection before. Mr. D. A. Brown also responded and spoke very encouragingly of the asbestos industry in the Eastern Townships.

Mr. FRANCHOT proposed "Our Science School and Professors," remarking that he felt grateful to the schools, and hoped that a kindly feeling between them and mining men would always exist.

Sir WILLIAM DAWSON replied. He referred to the fact that his interests in mining matters were more of an educational nature than a pecuniary one, and said that a very great deal of what was known as regards the structure of the earth to-day was due to the mining engineer and mine explorer, and geologists are extremely thankful to them for the information. Speaking of the School of Science recently established at McGill, he said that they looked to the members of this Association as educators of the young men who graduated therefrom. Your meeting here to-day will do more to assist you in asserting your rights, on account of the investigations carried on, than any direct agitation. He pointed out that the Canadian Mining Review, so ably edited by the energetic Secretary of the Association, Mr. B. T. A. Bell, must also be considered as a great educational power.

A humorous song by Mr. W. H. Irwin was followed by Mr. B. T. A. Bell presenting the toast "Kindred Associations."

Prof. H. T. BOVEY, representing the Canadian Society of Civil Engineers, responded briefly, as did also Mr. W. Hamilton Merritt, representing the Canadian Institute of Toronto, who made a kindly reference to the services of the late Hon. Thos. White, to whom the mining men owed a great deal for his assistance in the promotion of mining matters.

The last toast, "Our Guests," was responded to by Mr. H. Ward Leonard in a very happy manner, and thus was concluded the First Annual Convention of the Association, the members of which have every reason to congratulate themselves upon its success.

Sifting of Anthracite.—A committee representing 90 per cent. of the anthracite output of Pennsylvania, recommended on November 7th, 1890, the adoption of a uniform size of mesh for screens. The following sizes were selected, and will go into effect in January, 1891:

Egg,	through	2¾	inches,	and over	2	inches.
Stove,	"	2	"	"	1¼	"
Chestnut,	"	1¼	"	"	¾	"
Pea,	"	¾	"	"	½	"
Buckwheat,	"	½	"	"	½	"

The small stove size was abolished.

Mining in British Columbia.

By Thos. Drummond, Mining and Civil Engineer, A.M. Can. Soc. C.E.

Before the discovery of gold in British Columbia, or what afterwards became known as that province, it was a comparatively unknown country, under the control and government of the Hudson Bay Company, whose interests were bound up in the fur trade, and in that alone. In 1849, the Company's headquarters were removed from Fort Vancouver, on the Columbia River, to Fort Victoria, on Vancouver Island, which had been established in 1843. In 1851, James Douglas was made Governor of the Colony, vesting in his person the authority both of the Hudson Bay Company and the Colonial Government. In 1856, Vancouver Island was divided into four electoral districts, and seven members were elected. At this time the united white population of the island was about 300. After the discovery of gold on the mainland in 1857, and the consequent rush to the new country, Douglas was forced, by the increased responsibility of government caused by the conflicting interests of the fur traders and gold miners, to resign his position as head of the Hudson Bay Company, which he did in 1859. In the same year the Imperial Government re-purchased the exclusive right of the Hudson Bay Company to trade, and the Company, as a monopoly, ceased to exist on the Pacific Coast. In 1858, the Province of British Columbia was created, and Douglas became its first governor.

The discovery of gold, then, marks a new era in the history of the country, and though the stirring events of that time are now things of the past, still they are not without interest, for with them began the real history of the province, which, from being a country comparatively unknown, was raised to the dignity of being one of the great gold producing centres of the world.

People by the thousands and tens of thousands rushed to its shore, and in their search for the precious metal also discovered the capabilities of the country; so that, after the gold excitement, many settled down, and formed, so to speak, the nucleus of the future growth and prosperity of the province.

In the first part of this paper, then, I propose to give a history of the more important discoveries of gold, and the dates at which they occurred, and also a short description of the methods adopted in separating the gold from the alluvial washings in which it is found.

Before going on with the paper, I would like to state that, in the absence of actual statistics, the subject matter of this paper has been obtained from the most reliable sources available—in many cases from personal observations, and, where I had not the opportunity, from miners and others who actually worked at the places to be mentioned later on—men to whom I am greatly indebted for information, and whom I know personally to be little given to exaggeration. Statements were verified by comparisons when possible, and different authorities who had written upon the subject were also consulted, such as Dr. Selwyn, Dr. Geo. Dawson, and other members of the Geological Survey of Canada, Bancroft's History of British Columbia, Sessional Papers and Reports of the Provincial Government, J. W. McKay, and many others; so that, though the information and figures given are not in the nature of actual statistics, still they are near approximations of these taken from the most reliable sources. I mention this because reliable information upon this subject is difficult to obtain, and were all statements accepted this would read more like fairy land than what I wish it to be: a sober history of events which have occurred in the history of British Columbia, and which there is every reason to suppose will be repeated in the near future in a more permanent form when the discoveries in quartz, even those already made, have been sufficiently developed to show their value.

For convenience, I have divided the subject into—

(1) Placer Mining.
(2) Vein Mining.

The first authentic discovery of gold in British Columbia, or what afterwards became part of that province, was at Gold, or Mitchell's Harbor, on Queen Charlotte's Island, in 1851. The discovery was in the form of a nugget weighing about five ounces, found on the seashore by an Indian, who sold it to the Hudson Bay Company. A vessel was shortly afterwards sent out by the latter to examine the locality, resulting in the discovery of a small vein of quartz containing gold, from which it is estimated that ore to the value of $20,000 was obtained by the Hudson Bay Company and other adventurers. The deposit then proving limited, it was abandoned. About the same time, or a little earlier, Mr. McKay also found colors of gold at various places on Vancouver Island, between Victoria and Nanaimo, when exploring for land.

Hudson Bay Company's Journals also state that in 1852 Indians brought samples of gold from the Skeena River. G. B. McClellan's party also discovered gold on the Similkameen River in 1853, when engaged on exploratory surveys for the Northern Pacific Railway.

Gold was also discovered at Pend d'Oreille by Colville men in 1854 or 1855, and worked with success, and the finding of gold in British Columbia was a direct result of this discovery, for Indians from the Thompson River, visiting their friends near Walla Walla, stated that gold like that was found in their country. Accordingly, some French Canadians and Indians crossed over and discovered paying placers in the vicinity of Necoamen, on the Thompson River, in the fall of 1857. The news spread and caused the Fraser River excitement of 1858. California was at this time filled with a mining population, attracted there by the gold excitement of 1848 and 1849, and when the authentic discovery of gold on the Fraser

River became known, a perfect rush was made for the new El Dorado. From thirty to thirty-five thousand people are said to have come into the province early in 1858.

Many of these became discouraged and turned back, but those, however, who did reach the Fraser River, pushed their way onward and found gold in paying quantities on the bars and tributaries, from the mouth of Harrison River up both the Thompson and Fraser Rivers as far as the season of 1858 would allow them to go. Some of the more important of these bars were as follows:—Maria, Hudson, Cornish, American, Union, Cameron, Emory, Texas, Hills, Sailor, Wellington, Spuzzum, Chapman, Nicaragua, Boston, Yankee, Mariner's, Lytton, Morman, Foster, Lillooet, French, Robinson, Upper Morman, British, Ferguson, and Long Bars.

Of these, Hills Bar, just below the town of Yale, may be taken as an example of the richest. It is reported to have produced $1,000,000 worth of gold during the excitement, from an area of less than half a square mile, and from a report of the Minister of Mines in 1875, it is credited with having produced up to that time $2,000,000. On this bar four men washed $4,000 in six days. Ned McGowan, of historical fame, took out $33,000 in three months. It is also said that the present site of the town of Yale with the flat opposite would yield a large amount of gold if worked by hydraulic power, and I understand that a company is now being formed with that object in view. The gold in the bars, especially below Yale, was fine, and in shallow ground, and at first they were only mined a little below the surface of the river, and in the most primitive manner, with pick, shovel, rocker and pan, and yielded, when worked even in this way, large returns of gold. Between Yale and Hope one rocker yielded $830 in eight days, another $800 in twelve days, and a third $248 in five days, and at Yale 150 rockers gave in one day 723 ounces. Sailor Bar is said to have averaged one ounce a day per man, and two to five ounces was quite common. As the surface of the bars was washed out, wing damming was resorted to, where possible, to reach deeper ground. Many flumes and ditches were also built to carry water to the benches along the river; they varied in length from one to fourteen miles, and cost many thousands of dollars. Water wheels were also built, one below Cornish Bar being 30 feet in diameter.

These pioneers and prospectors had many difficulties to overcome in making their way up to the new diggings. At first there were no steamers to the mouth of the Fraser, and afterwards, when there were, a great many were unable to pay their way, so they went from Vancouver to the mainland in canoes and small craft built by themselves, and many were lost in the dangerous tide rips and currents of the coast. Early in 1858, it was found that the Fraser River was navigable as far as Yale, which became the distributing point for the upper country. Beyond this, the country was rough, mountainous and comparatively unknown, and travelling by land and water was hard and laborious work. Supplies were scarce and difficult to transport, and the Indians, for a time, were hostile. Is it strange, then, that many became discouraged and turned back? The wonderful thing to my mind is, that so many succeeded in forcing their way onward through so many difficulties and dangers.

In the fall of 1859, rich diggings were discovered on Quesnelle River, and this stopped the onward march for a time.

In 1860, Keithley Creek was discovered, and this marks a renewed era of prosperity in mining, for with it was discovered the famous Cariboo District, one of the richest placer mining centres ever found.

In the winter of 1860 and 1861, miners discovered Antler Creek. They tried to get a grant of this stream from Governor Douglas in Victoria, but it was refused. The news became known and caused a second influx of miners, this time to the Cariboo District, During the same year (1861) William's, Grouse, Lightning, Jack of Clubs, Lowhee and other creeks, which have since become famous, were discovered. Of these, William's, Grouse and Lightning were the richest. These creeks, with their tributaries, yielded, up to the end of 1861, some $2,000,000.

William's Creek was discovered by William Dietz, better known as Dutch Bill. He located in the canon, and his claim, though the Discovery, turned out to be one of the poorest on the creek. Other owners located ground along the creek about the same time. The ground was supposed to be shallow, the yield of gold was poor, and he creek was known for a time as Humbug Creek. The first run of gold was found in shallow ground, over a stratum of blue clay. To test below this, Abbott & Co. sunk a hole 4 x 7 feet, and took out 57 ounces of gold, and the other companies soon followed their example. Deep ground was located in an old channel behind the canon, and also below it, by Black Jake, Barker, Cameron and others, and Barkersville, Camerontown and Richfield were started. Starting at the head of the stream and going downwards, some of the claims were as follows:—

Steel & Co.,
Point Claim,
Abbott & Co.,
12 Foot Davis,
Adams and Wilson,
Casto & Co.,
Dutch Bill,
Diller & Co.,
Canadian Co.,
Welsh Co.,
Wake Up Jake Co.
Cariboo Co.
Aurora,
Lillooet Co.,
Forest Rose,
Cameron & Co.,
Tinker Co.
Raby & Co.,
Caledonia Co.,
Grizzly Co.,
Never Sweat Co.,
Ballarat Co.,
Prince of Wales,
Sheepshead,
Coonskin,
—and others.

As may be seen from the following examples, William's Creek was immensely rich. Diller is said to have taken out 202 lbs. of gold in one day, with only two men drifting; this represents about $38,784. Steel & Co.'s claim yielded, on two consecutive days, 387 and 409 ounces of gold, and in two months, $105,000. The Cunningham claim averaged 125 ounces of gold for the season of 1862, and on several occasions gave 600 ounces, or 50 lbs., a day. The Adams Claim yielded each of its three owners $40,000. The Caledonian gave for a time $5,000 to $6,000 a day, and the Cameron and Tinker were not far behind.

The Raby, in one day, yielded 310 ounces of gold, as witnessed by Milton & Cheadle. The Point Claim yielded $90,000 in dividends. The Wattie Claim $85,000. The 12 Foot Davis, a gore between two other claims, $25,000. Diller took out $100,000. Cariboo Cameron, $160,000. In 1863, three claims below the canon produced $300,000, and twenty claims were steadily producing from 70 to 400 ounces per day. In the Aurora one pan of picked dirt is said to have yielded 387 ounces, and $600 to $900 to the pan was obtained on several occasions. The Erricson Claim, according to the Victoria *Colonist*, produced for seven consecutive weeks, between June 17th and July 29th, 1864, as follows: 900, 640, 1,400, 1,926, 1,256, 1,300, and 2,600 ounces. Two miles of creek is said to have averaged $1,000 to the running foot, and that this is within possibilities may be seen from the following statement:—

Adams Claim	100 feet	$120,000
Steele "	80 "	120,000
Diller "	50 "	240,000
Cunningham "	500 "	270,000
Burns "	80 "	140,000
Canadian "	120 "	180,000
Never Sweat "	120 "	100,000
Moffat "	50 "	90,000
Tinker "	140 "	120,000
Watty "	100 "	130,000
	1,340	$1,510,000

—or say $1,127 per running foot of creek.

Next in importance and richness was Lightning Creek, also discovered in 1861. For a time the annual yield is said to have been larger than on William's Creek, but it was not so lasting.

In 1861 the Campbell & Whitehall adjacent claims yielded $200,000, and Campbell is said to have taken out 1,700 ounces of gold in three days, as follows: 1st, 900 ounces; 2nd, 500 ounces; 3rd, 300 ounces. In 1870 the deep channel was bottomed, leading to the subsequent discoveries. At one time the Butcher, Aurora and and Caledonia Claims yielded respectively as follows: Butcher, 350 ounces per day; Aurora, 300-600 ounces per day; Caledonia, 300 ounces per day. The old channel was worked for a distance of 16,000 feet, and is said to have yielded $300 to the running foot. The following statement, taken from the report of the Minister of Mines for 1875, showing the yield of some of the more important claims, will give some idea of the amount produced by this creek:

Campbell & Whitehall	$200,000
Dutch & Seegel	130,000
Dunbar	30,000
Lightning	153,962
Discovery & Butcher	120,000
South Wales	141,531
Spruce	99,908
Point	136,625
Van Winkle	363,983
Victoria	451,642
Vancouver	274,190
Vulcan	56,955
Costello	20,476

A statement obtained by myself from miners, and supposed to give the total yield, is also given. The figures are much larger, and are perhaps exaggerated, though given for a later period than the above:

Van Winkle	$600,000
Victoria	600,000
Vancouver	300,000
Point Claim	180,000
South Wales	200,000
Lightning	220,000
Butcher Bench	250,000
Dunbar Flat	150,000
	$2,500,000

Grouse Creek was also very rich. Mr. Heron, the discoverer of the famous Heron Lead, told me that his company took out from 100 to 400 ounces per day, and made $300,000. The old channel was followed for about a mile, giving immense yields, and was then lost.

Antler Creek also yielded a large amount of gold, both from the benches and gulches, and also from the bed of the stream. The gold was taken from shallow ground, as the stream was never bottomed. One company made $83,000 in three weeks. The creek yielded $10,000 a day for some time in 1861, and some spots are said to have yielded as much as $1,000 to the square foot. Besides these, there were Jack of Clubs and Lowhee Creeks, and all the tributaries, gulches and ravines of the above streams, which, though not so rich, yielded in the aggregate a large amount of money and many independent fortunes. Some of these were as follows: Van Winkle, Chisholm, Last Chance, Davis, Anderson, Harvey, Cunningham, Cedar & McArthur's Creeks, and numerous gulches, ravines and valleys.

These deep places, however, were expensive to open before any return was obtained, and the actual working expenses were also heavy. The Van Winkle mine cost $40,000 to open before the channel was reached; it yielded a large amount of gold afterwards, however, three consecutive weekly clean-ups being as follows $15,700, $14,000 and $12,000; Cunningham Claim cost $100,000 to open work, and yielded $500,000. The California Claim, about the same cost and yield, also the Tontine. The Black Jack cost about $50,000 to open and work, and yielded $200,000. In Raby & Co.'s claim the pay roll for two weeks is said to have amounted to $12,000. Mr. Heron, the discoverer of the famous Heron Lead on Grouse Creek, told me that their weekly pay roll amounted to from $1,200 to $2,300. The great expense of working can easily be accounted for. The pay dirt was deep all the way from 30-90 feet, large pumps were required to keep the water down, often long bed rock ditches for discharging water were required, and expensive timbering was also necessary.

The timber, which was massive, cost 8c. per running foot, and lagging $7 a hundred pieces. The District was also far removed from any civilized centre, and provisions, supplies and transport were expensive, as may be seen from the following statement, which may be taken as an example of the highest prices paid at Cariboo at any time:—

Flour	$1.50 per pound
Bacon	1.50 "
Tea and Coffee	3.00 "
Sugar	1.50 "
Beef (fresh)	0.60 "
Beans	0.75 "
Nails	0.75 "
Boards	0.25 per foot
Gum boots	$30.00 to $50.00 a pair
1 spool thread	$0.50
1 clay pipe	0.50
1 needle	$0.50 to $1.00
Wages per man per day	$10.00 to $16.00

Packing from Quesnelle Mouth to Williams Creek by man power cost from $0.85 to $1.00 per lb.

Exorbitant freight rates consequent upon the inadequate preparations for the great rush were the causes. "It is not the first cost of the goods," said a trader to a miner, when selling him a darning needle for a dollar; "it is not the first cost of the goods, mine friend; it is the freight."

The distance to Cariboo via Harrison River, was 520 miles. Lillooet was the headquarters for the pack trains, which were inadequate to accommodate the great numbers, who, therefore, had to resort to all kinds of devices, packing on the back with dogs and with oxen. Mr. Cannel, who is well and favourably known at Kamloops, told me that he bought an ox at Lillooet, which was the first pack animal to go into Williams Creek, where it was killed, dressing some 900 lbs., and sold for 60c. per lb. Camels were also imported for packing purposes, several of which are still alive, and to be seen not far from Kamloops. The waggon road to Cariboo was finished in 1865. Stages were run, carrying passengers, mail and express, and easier access and cheaper supplies were the result.

The telegraph line was also bought by the Provincial Government about the same time. This telegraph line is famous, for it formed part of the line built by the Western Union Telegraph Co., which was to have crossed at Behring's Straits, and which was rendered useless as a transcontinental line by the successful laying of the Atlantic Cable.

I have given a somewhat detailed description of the Cariboo District, because it was the most important of the British Columbia discoveries, and it gives at the same time, a good example of typical life at a successful mining camp. As might be expected, lawless characters congregated, and gambling and kindred vices were prevalent. A Spanish packer, being asked if the Cariboo diggings were rich, answered that he had doubted it till he saw $27,000 gambled away in one sitting by three miners. But wise, just and capable men were in charge, and not a single case of murder is said to have occurred in Cariboo, which is an agreeable contrast to the scenes enacted at the mining camps in the neighbouring Republic. Chief Justice Begbie was a terror to evil-doers, to whom sure and impartial judgment was administered. Crime became, comparatively, unknown, and fire arms were practically discarded. This is all the more surprising, when we consider that the yield of gold was measured, not by the ounce, but by the pound; it became so plentiful that it was troublesome to ground, and miners returned ragged and rough, with so much gold, that men and mules had to be engaged to transport it. According to Macfie's estimate of those who went to Cariboo in 1861, one-third made independent fortunes, one-third made several thousand dollars, and one-third returned unsuccessful.

During the Cariboo excitement, mining camps of less importance were almost depopulated, and were only worked during later years when the Cariboo excitement had subsided. Among these were Tranquil Creek, Louis Creek, Jamison Creek, Barrière River, Adams River and Lake, Deadman River, Nicola River, Scotch Creek, and, in fact, nearly all the streams running into the Thompson River in the vicinity of Kamloops. They were discovered pricipally in 1858 and 1859, and, in many cases, have been worked almost without intermission ever since, principally by Chinese.

ROCK CREEK AND SIMILKIMEEN DISTRICT.

Discovered in 1859 and 1860, and mined to some extent at that time and then abandoned for Cariboo.

Between 1882 and 1888, mining was renewed, and many new discoveries made. The principal streams worked up to date are as follows :—

Similkimeen River,
South Fork, Similkimeen River,
Whip Saw Creek,
Nine Mile Creek,
Tulimeen River,
Granite Creek,
Collins' Gulch,
Cedar Creek,
Slate Creek,
Bear Creek,
Rock Creek,
Boundary Creek,
Mission Creek,
Cherry Creek.

This district yielded between 1885 and 1888, $553,500, out of which Granite Creek produced $383,000. The latter creek was discovered in 1885, and caused quite an excitement for a time.

Cherry Creek also yielded well, and has been worked almost without intermission ever since ; in later years, principally by Chinese. I saw a piece of ground in this stream which had been worked over three times in seven years, and was then, according to Chinamen working there, yielding from $3 to $5 a day per man.

EAST AND WEST KOOTENAI DISTRICT.

First discovered in 1863. In 1865, 1,000 miners at work, getting from one to three ounces a day per man. The yield between 1874 and 1888, after the more successful days, was $582,878. This also includes returns from the Big Bend country.

The principal streams were :—

Wild Horse Creek,
Bull River,
Findlay Creek,
Dutch Creek,
Toby Creek,
Canon Creek,
Quartz Creek,
Perry Creek.

The streams were discovered at various times between 1863 and 1888. Wild Horse Creek produced, between 1878 and 1888, $255,780.

BIG BEND DISTRICT.

The principal streams mined were as follows :—

French Creek,
McCulloch's Creek,
Downie Creek,
Carnes' Creek,
Smith's Creek,
Fernie Creek.

It was discovered in 1865, and the principal mining was carried on in 1866, and in that year French and McCulloch's Creek each produced about $100,000, and four, six, and twelve ounces per day per man was not uncommon. One nugget worth $253 was found.

OMENICA REGION.

Discovered in 1869. The principal streams were :—

Vital Creek,
Silver Creek,
Omenica River,
Germanson Creek,
Mansen Creek,
Lost Creek,
Black Jack Gulch,
Finlay River,
Bars on Peace River.

This district produced between 1874 and 1888, $350,000. This does not include the first and more prolific years, the yield of which is unknown.

CASSIAR DISTRICT.

The Stikeen River was first discovered in 1861 and worked for a time, but not with great success.

Cassiar proper was discovered by Thibert and McCulloch, who came overland from the Red River country. The district yielded, between 1873 and 1888, about $5,200,000. The principal streams were :—

Dease Creek,
Thibert Creek,
McDames' Creek,
Walker's Creek,
Snow Creek,
Quartz Creek,
First North Fork of McDames' Creek.

Miners went to Cassiar by ocean steamer from Victoria to Fort Wrangell, at the mouth of Stikeen ; then up the latter river for a distance of 150 miles to Glenora Landing by river steamers. Then across an 80 mile portage to Dease Lake, where a small steamer had been built. The Stikeen River runs within three miles of Dease Lake ; but it is not navigable on account of the great canons of the Stikeen, about 90 miles long.

A trail was cut from Quesnelle Mouth to Dease Dake, a distance of about 425 miles. During the first year, freight across the 80 mile portage was 50 cents per pound, and poor pack-horses cost $250 each.

YOUKON DISTRICT.

Though this is beyond the boundary of British Columbia, I have included it here because its discovery is due to a great extent to the miners from Cassiar.

The principal streams are :—

Sayyea Creek,
Finlayson River,
Lewis River,
Big Salmon River,
Upper Pelly River,
Ross River,
Stewart River,
Forty Mile Creek,
Sixty Mile Creek.

Rich diggings have been discovered, but, owing to the remoteness of the district, difficulty of obtaining supplies, and shortness of the season, it has not been worked to a great extent as yet.

SKEENA RIVER AND STREAMS OF THE COAST RANGE.

These include :—

Skeena River,
Seymour Creek,
Prospect Creek,
Lorne Creek,
Bones Gulch,
Douglas Creek.

Lorne Creek was the best, and produced as follows : In 1884, $17,000 ; 1885, $18,000 ; and in 1886, $12,000.

VANCOUVER ISLAND.

Leech River,
Sooke River,
Jordan River,
Nanaimo River,
San Juan River,
Cowachin River,

were the principal streams ; of these, Leech River is said to have produced $150,000 ; and Jordan River about $35,000.

A tabular statement from the Report of the Minister of Mines, shewing the total estimated yield of gold between 1858 and 1888, is as follows :—

GOLD PRODUCTION.

TABLE shewing the actually known and estimated yield of gold ; the number of miners employed ; and the average earnings per man, per year, from 1858 to 1888, in the Province of British Columbia :

YEAR.	Am't actually known to have been exported by banks, etc.	Amount added to represent gold carried away in private hands.		Total.	Number of miners employed.	Average yearly earnings per man.
	$		$	$		$
1858, partial ret'n	543,000		......	*705,000	3,000	235
1859	1,211,304	⅓rd	403,768	1,615,072	4,000	403
1860	1,671,410	"	557,133	2,228,543	4,400	506
1861	1,999,589	"	666,529	2,666,118	4,200	634
1862	1,992,677	"	664,226	2,656,903	4,100	648
1863	2,935,172	"	978,391	3,913,563	4,400	889
1864	2,801,888	"	933,962	3,735,850	4,400	849
1865	2,618,404	"	872,801	3,491,205	4,294	813
1866	1,996,580	"	665,526	2,662,106	2,982	893
1867	1,860,651	"	620,217	2,480,868	3,044	814
1868	1,779,729	"	593,243	2,372,972	2,390	992
1869	1,331,234	"	443,744	1,774,978	2,369	749
1870	1,002,717	"	334,239	1,336,956	2,348	569
1871	1,349,580	"	449,860	1,799,440	2,450	734
1872	1,208,229	"	402,743	1,610,972	2,400	671
1873	979,312	"	326,437	1,305,749	2,300	567
1874	1,383,464	"	461,154	1,844,618	2,868	643
1875	1,856,178	"	618,726	2,474,904	2,024	1,222
1876	1,339,986	"	446,662	1,786,648	2,282	783
1877	1,206,136	"	402,045	1,608,182	1,960	820
1878	1,062,670	⅕th	212,534	1,275,204	1,883	677
1879	1,075,049	"	215,009	1,290,058	2,124	607
1880	844,856	"	168,971	1,013,827	1,955	518
1881	872,281	"	174,456	1,046,737	1,898	551
1882	795,071	"	159,014	954,085	1,738	548
1883	661,877	"	132,375	794,252	1,965	404
1884	613,304	"	122,861	736,165	1,858	396
1885	594,782	"	118,956	713,738	2,902	246
1886	753,043	"	150,608	903,651	3,147	287
1887	578,924	"	115,785	693,709	2,342†	296
1888	513,943	"	102,788	616,731	2,007	307

Total known and estimated yield of gold, 1858 to 1888............	54,108,804
Average number of miners employed yearly........................	2,775
Average earnings per man per year.	622

From it, the total yield of gold is $54,108,804. Assuming that the average value of the gold was $16.75 per ounce, this gives 3,230,377 ounces, or 269,200 lbs., and, taking the specific gravity of the gold as being 16, a cubic foot weighs 1,000 lbs. This gives 269.2 cubic feet, or it may be represented by a solid pyramid, with a square base, whose sides are six feet and height 22½ feet.

Of this amount, Cariboo is credited with producing about one-half. According to this statement, the average earnings per man, per year, for thirty-one years, were $622. Another average is from 1,200 miners, who crossed the bridge at the mouth of the Quesnelle early in 1861. Twenty soon returned, discouraged ; the remainder returned in the fall, bringing down as their season's earnings, $1,500,000—or say, an average of $1,272 each.

From the foregoing you may, perhaps, imagine that placer mining has ceased in this province ; this, however, is not the case—it has certainly fallen off from the yields in the palmy days, but, as may be seen from the statement it still produces annually nearly $800,000 worth of gold.

The shallow placers are, of course, practically exhausted ; but, with better roads, cheaper supplies, improved machinery, and the method of working by hydraulic power, the miner still obtains a good return for his labors, and will for many a year.

There is little doubt, also, that during the course of the next few years much of the deep ground in the Big Bend, Kootenay, Similkimeen, Cassiar, Cariboo, and other districts, which, from its remoteness, was abandoned during the early days, will be tested and yield rich returns.

It is quite in the region of possibilities that new and rich placers may be discovered. The district between the head waters of the North Thompson and Cariboo is looked upon as being one of great promise.

Dr. Geo. Dawson, and other authorities of the Geological Survey, also consider that it is quite possible, if not likely, that rich placers may be discovered belonging to older formations and periods than those which have been worked. Such, for instance, as the extensive gravels of the Middle Tertiary, which were afterwards covered by basalts and other igneous rocks, and there is reason to suppose that the modern placers have been considerably enriched by the robbing of these old gravels. Still older conglomerates, as far back as those of the Carboniferous, have been successfully worked in several countries. These considerations are not merely of a theoretical nature, but are warranted by experience gained in California and other localities in the United States, in Australia, in New Zealand, and in Nova Scotia.

I have treated this part of the paper more in detail than I first intended, but I think it deserves attention because, as far as I am aware, it is not generally known that the Province of British Columbia has and still is producing gold in such quantities ; and, in view of the discoveries of quartz within the past few years, I think it is only fair that attention should be directed to this point.

Before going on with the paper, it is, perhaps, not out of place to say a few words regarding the origin of the gold in the sand and gravel.

One theory is that, through the action of organic acids and alkalies, the gold is brought into a state of solution, and in this condition is carried by streams to other localities, where it is re-precipitated in the form of nuggets by organic matter, such as fragments of coal, etc. In a geological sense, then, gold may be, and probably is, largely distributed in this way. The usual theory, however, is that, through the agency of air, frost, etc., pre-existing vein matter and rocks containing the gold became decomposed and destroyed, and the indestructible gold is then deposited in a concentrated form in the various localities where it has been found, by the following agencies :

(1) The present system of water courses.

(2) Older systems of water courses, following the same general directions as the present systems, and in many places coinciding with the latter.

(3) Still older water systems.

(4) By the action of glaciers.

By these agencies, then, the gold is deposited with varying richness in many localities. In the beds of modern streams, in the older channels, on benches, in gulches, valleys, and ravines; sometimes near the surface, but often deeply buried under barren soil or igneous rock. Being found under so many varying circumstances, much must be left to the ingenuity of the miner. The general principles, however, for working are about as follows :—

METHODS OF WORKING PLACER MINES.

The following tools, appliances, and requisites are used in one form or another in placer mining, though, in individual cases, all may not be required. A plentiful supply of water, picks, shovels, axes, drills, hammers, crowbars, wheelbarrows, hoisting bucket, rope, nails, magnet, blowpan, cross cut saw, whip saw, small car, miners' pan, cradle, quicksilver, pumps, derricks, water wheels, sluices, wing dams, etc.

Most of the above appliances are in such general use that a description is unnecessary; with the following, however, it is not out of place :—

The Miner's Pan is made of pressed sheet iron, is circular in form, about 14 inches in diameter on the bottom, 18 inches on the top, and five inches deep. It is used for separating the gold from the gravel by a sort of circular motion given to it in water, the pan at the same time being held in a sloping position. By this means the lighter sand and gravel drops over the lower side, while the black sand and gold remain behind. The remainder is then dried on a shovel or fry-pan in the fire, and the black, magnetic sand is then removed with the blow-pan and magnet. The pan is also used for cleaning concentrates from sluices and cradle, and also for washing gold amalgam where mercury is used. It is especially useful as a prospecting tool.

The Cradle or Rocker is also of more importance as a prospecting tool. It is a rough, wooden box, say 40 inches long, 20 inches wide, and 20 inches deep. On the bottom it is fitted with rockers like a baby's cradle, and it is slightly inclined, say two to four inches. At the upper end and on the top, is a hopper, or coarse sieve, into which the gravel is thrown. The finer portion of the latter passes through and falls into the apron usually made of blanket. On the bottom, below the apron, riffles are placed, and the lower end is left open. The dirt is shovelled into the hopper, water is poured in with one hand, while the rocking motion is given with the other hand. The fine dirt and gold pass through, some of the gold is caught in the nap of the blanket, the balance on the riffles, while the water and waste dirt run out at the lower end.

A Puddling Box is sometimes used, especially if there be much clay. It is a box of any size, and has an augur hole about four inches from the bottom. The augur hole is plugged, the clay put in and puddled with plenty of water. The water and suspended clay are then run off through the hole, leaving the black sand and gold as before.

The Wing Dam is to turn the water from the claim. It starts at the head, runs in a slanting direction across the stream till about one-half is taken in, and then runs straight down for the remaining distance. The whole is weighted with heavy stones to keep it in place, and filled with soil and gravel to make it water-tight. It is built of timber. The space within the dam is then worked down to bed rock, and the dam is finally changed over to the other side, which is worked in the same way.

The Water-Wheel is used for hoisting purposes and for pumping water. In shallow places it is an undershot

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* Waddington's estimate.

† Exclusive of a number of men working on or prospecting for quartz.

wheel, projecting over the side of the dam into the water, and running the pump, which is attached to it on the inner side.

The Sluice Boxes are made from boards which are generally sawn by the miners themselves with the whip-saw. The planks are usually 12 feet long and 1 to 2 inches thick. These are formed into boxes 16 to 20 inches wide and 12 inches deep, for ordinary placers, and larger for more extensive workings. They are made a little narrower at one end so as to fit into each other, and soon become water-tight. These boxes are then set in strings, supported on trestles, and are given an inclination of from 2 to 10 inches per box of 12 feet, depending on the character of the gravel and gold, and the available grade which can be given them.

The boxes are provided with riffles of various forms to catch the gold, which is generally coarse ; quicksilver is, therefore, not much used. Where fine, both quicksilver in the crude state and amalgamated plates are used.

Placer mining may be divided into the mining of

(1) Shallow placers.

(2) Deep placers.

Shallow placers are such as are opened from the surface, the whole of the dirt being washed down to bed rock, the latter being not more than, say, 12 feet deep. They include the shallow beds of permanent streams and dry gulches, ravines and valleys, carrying water only during part of the season, or perhaps carrying none at all. They may thus be sub-divided into

(*a*) Wet diggings.

(*b*) Dry diggings.

Deep placers, on the other hand, are such mines as are opened from beneath, or both from beneath and above, as in the case of hydraulic mining. The pay dirt is deeply buried under barren soil, so that it would not pay to remove the latter, and mines are therefore opened by shafts, tunnels and bed-rock flumes, which require to be heavily and securely timbered. Mining of this description may also be classified under two heads, viz. :—

(*a*) Deep placer mining by hand.

(*b*) Hydraulic mining.

Let us first take a case of shallow placer mining, under class *a*, or wet diggings.

The boundaries having been staked out, the wing dam is first put in, and is closed across the lower end of the claim, or, as is usually the case, carried on far enough to keep the claim clear of water. The water-wheel and pump are then put into position, the wheel projecting over the side of the dam into the water, the axle of which actuates the pump, which in this class of mining is usually of a primitive character, consisting of a wooden box, through which a series of canvas buckets are carried on an endless band. The sluice boxes are then strung out in position, the slope and length depending upon the character of the gold, the available grade, and the means of the miners. As a general rule, the larger the string of boxes the more thoroughly is the gold saved. The riffles are then put into the sluice boxes. All then being in position, water is admitted into the sluices, the pump is set in motion, and the process of shovelling in the sand and gravel goes on. The latter is carried through the sluices by the force of the water, and goes off as tailings, while the gold and heavy black sand settle into the riffles, from which it is removed at stated intervals, usually at the weekly clean up. The process of working a shallow dry placer is much the same, save that, as water is absent, enough to supply the sluice must be brought by ditches, and the wing dam is unnecessary.

Mining laws in British Columbia limit the size of placer claims, which can only take in 100 feet in length of stream, in the case of creek and bar diggings, and 100 feet square in bench and dry diggings. Where a new stream is discovered these claims, as above are staked off and if the ground is shallow it is worked as has been described. If, on the other hand, the ground is deep, as is usually the case in the old channels and also in many of the modern streams, such methods would be too expensive to employ, and in such cases deep placer mining by hand is resorted to. This consists essentially either in running a drift or bed-rock flume to strike the bed rock, or in sinking a shaft at the side of the stream in solid ground, and drifting out to strike the bed rock, in which the shaft goes down through the rim rock forming the banks of the stream, and at the lower end of the claim. When the miners think they are deep enough a trial drift is run out to strike the bed rock of the present stream or old channel, as the case may be ; and when this is struck the gravel is hoisted through the shaft to the surface, and washed in sluices as before. These underground workings require to be heavily and securely timbered, for the life of the miner to a great extent depends upon this. Powerful pumps are also required to keep the drifts clear of water. The hoisting and pumping gear is usually actuated by water power obtained from water wheels, and if the height to which the water has to be lifted is too great, flumes from one claim to another, the expense of which is shared by the various companies, require to be built. A better plan, when practicable, is to run a tunnel, with sufficient slope for drainage, to strike the bed rock at the required place ; the sluices are then set in the tunnel, if water can be admitted ; if not, at the mouth of the tunnel, and washing goes on as before. Bench claims being in dry ground, and often high above the level of the streams, are easier to work. The main difficulty there is to bring water to the ground ; to do this, long ditches are often required. Water wheels are utilized when practicable, one such wheel on Quesnelle River being 60 feet in diameter. In the vicinity of Clinton, in a piece of ground where water was difficult to obtain, it was brought across the Fraser River in rubber hose. We can thus see that much ingenuity is exercised by the miner in accomplishing his end.

Such methods as the above are utilized when the diggings are shallow or reasonably so, and when they are rich enough to bear the expense of such costly work. When this is not the case, or when the richer ground has been exhausted, the ground can only be profitably worked by hydraulic power. In view of the fact that much of the mining ground now left in British Columbia is of this character, I propose to give a more detailed description of this method of mining, from which, in the course of the next few years, much in the way of development can reasonably be expected.

In such cases small claims, as specified above, could not be profitably worked ; and to encourage the industry leases of mining property are given as follows :—

In dry diggings, 10 acres.

In bar diggings, unworked, ½ mile in length along high water mark.

In bar diggings, worked and abandoned, 1½ miles in length along high water mark.

In creek claims on abandoned streams, 1½ miles.

In bench lands adjoining unworked or abandoned streams, 160 acres.

Hydraulic mining is that process of extracting gold from auriferous gravel by means of water under great pressure, discharged through pipes and nozzles against the bank. Or, in other words, the same agency which originally buried and concentrated the gold in the gravel is by this method forced to strip and separate it again.

It is absolutely necessary that there should be :—

(1) A plentiful supply of water under pressure.

(2) Good facilities for grade and dump.

The richest deposit of gold is found usually in a stratum eight to ten feet thick immediately over the bed rock of the old channel ; and if this is slate, as is generally, though not necessarily, the case, it also penetrates into the crevices, seams and holes ; so that such bed rock is more likely to be rich than smoother and harder rocks. Such a deposit being suspected or known, it is first necessary, or at all events desirable, to explore the ground by means of shafts and drifts to learn something about the depth, extent, character and richness of the deposit. A plentiful supply of water must also be provided for, and brought to the ground by ditches, flumes, or pipes.

The *site of the tunnel* is then chosen, giving due regard to the disposal of tailings, and the grade which should be given to provide for the drainage of the mine and the economical washing of the gravel. The *size of the tunnel* must also be decided. This depends upon the extent of the deposit and how it is to be worked ; that is to say whether a single or double line of sluices is to be employed.

The *sluices* and riffles must also be prepared—no small undertaking, when it is remembered that, in some cases, they are over a mile in length. They may range in size from 16″ in width and 12″ in depth, to five feet or more in width and three feet in depth. They are made from planking, one to two inches thick, securely and tightly put together, and must be strongly mounted on sills and firmly supported by trestle work where necessary, to withstand the great pressure of water. The *riffles* are of various forms, and differ materially from those employed in ordinary placer mining, some of the more common and better forms being as follows :—

Block Riffles are of two kinds, namely *Square Block Riffles* and *Round Block Riffles.* In the first case, the blocks are sawn, good dimensions being 10 x 10 x 10 inches, but the size, of course, may vary ; these are placed in position, with spaces between, in much the same way as block pavements on our roads are laid. The round block riffles are blocks sawn square off from the trunks of trees and set on end in the sluices.

Rock Riffles are stones laid in place in the same way, and are durable, effective and cheap ; but are more difficult to remove when cleaning up. They can be very profitably employed in the lower part of the sluice, where the catch of gold is not so great.

Rail Riffles made from scantling, built in sets usually of about eight feet long ; the upper part is protected by strips of iron, and the whole is laid lengthwise in the sluice. Or the riffles, as a whole, may be a combination of the above methods.

The length of the sluice depends mainly upon the disposal of the tailings, for all the coarse gold and a large percentage of the fine gold is found in the first 400 feet of the sluice. The slope given to the boxes depends upon the character of the gold and the gravel in which it is found, heavy material requiring more slope and water than lighter material. If the grade is too great, the sand is apt to pack in the riffles, and a slope of about seven inches to the box of 12 feet generally works well.

Grizzlies and *undercurrents* are also used. A *grizzly* is put in when a drop can be given to a line of sluices, and is especially necessary when cement and pipe-clay are present. They consist essentially of parallel iron bars, such as pieces of railroad iron, set with spaces between, which allows the finer material to pass through, the cement and clay being pulverized by the fall into the sluice or undercurrent below, while the heavy boulders go over the side.

Undercurrents are large settling boxes, say 20 x 40 feet (the size varies), set to one side of the line of sluice boxes, and with less slope than the latter. They are provided with riffles as in the sluices. The water enters at the upper end and re-enters the sluice at the lower end. Most of the remaining gold is caught in these undercurrents.

These preliminaries having been settled, the work of opening the claim begins as follows : The tunnel, or open cut and tunnel combined, is started with the proper grade to strike the deposit, say 20 feet below bed rock to provide for contingencies, such as holes, etc., and also to make sure of being below bed rock ; otherwise, it is money and labor lost. The tunnel is securely timbered as the work progresses, and is carried well into the bed rock under the deposit, curves being avoided as much as possible. A shaft, usually vertical, is then sunk either to strike the tunnel directly, or at a short distance to one side, and, in the latter case, the two are connected by a short drift. The shaft must be securely timbered and lagged throughout to within about eight feet of the surface. The ditches, or sluices, carry the water to a distributing point, usually some high point convenient to the claim, where the pressure box is situated ; from the latter it is carried by iron pipes or canvas hose to the claim, nozzles being provided to direct the water against the bank. Good forms of the latter are fitted with ball and socket joints, so that they may easily be turned in any direction. The pipes are made of light sheet iron, and fit into each other like stovepipes ; or they may have lead joints, if thought advisable. All being in readiness, water is turned on and washing through the shaft begins. The first washings must be made with care, and all the soil or gravel within as great a radius as possible carefully sloped and drawn toward the mouth of the shaft before the timbering is removed. By this means caves and washes are avoided. As the work progresses, the timbers are removed till bed rock at the bottom of the shaft is reached, and, finally, an open cut in front of the tunnel is made. The mine may then be said to be opened. The bank is undermined, caved, and washed into the bed rock flume, here taking the place of the sluice boxes, and the latter is carried forward as the bank recedes. *Quicksilver* is largely employed, the charging being done at the head of the sluice. It is added at intervals, as required, being regulated by the amount in view in the riffles. The quantity used depends upon the length of the sluice.

Hydraulic mining is a development from California, and it has been largely employed both there and elsewhere in the States, where long and expensive lines of ditches and iron pipes have been built, the latter being provided with automatic air valves, distributing gates, and improved nozzles. Immense dams, forming storage reservoirs for use during the dry season, were also built. By this method, large quantities of gravel, up to nine and ten thousand cubic yards, can be run through the sluices in a single day. The average cost is about six cents per cubic yard ; so that gravel yielding only 10 to 20 cents per cubic yard can be profitably worked.

Hydraulic mining is successfully carried on in British Columbia, but in a more primitive and very much less extensive manner than above. The expensive preliminary work is unnecessary, for the process, so far, has been carried on in a small scale in Cariboo and elsewhere, where, from previous workings, the ground is known to be at least rich enough to yield fair returns ; water is also plentiful. Against these advantages we have the shortness of the season to contend with.

The disposal of such quantities of gravel is a serious question ; streams become choked up, and bottom lands are buried under the rush, and in many parts of the States it has become illegal to mine in this way. But we need never fear that this will be the case, at all events in the northern parts of the province ; and the successful operation of mines by this method will, there is no doubt, open and develope parts of the province otherwise useless, and foster and encourage an industry furnishing a livelihood and independence for many miners.

VEIN MINING.

For convenience I have classified the various discoveries of minerals in British Columbia under the above heading. The term is not strictly accurate, notably so in the case of coal and iron, and is adopted for description only, for it is beyond the scope of this paper to speak of the treatment of ores and methods of mining as the industry is in its infancy still. I purpose, therefore, merely to give a brief account of some of the more important discoveries of minerals in the Province.

As has been stated before, the placer miner is, so to speak, the pioneer of the quartz miner, it is only reasonable to suppose that in the case of rich placer deposits surmises should be made as to the origin of the gold, and if the latter is found to have a coarse unworn appearance with fragments of quartz adhering, we may safely take it for granted that this source is not far distant ; and when in addition to this, fragments and nuggets of other minerals, such as silver, copper, lead, platinum, etc., are found in the sluice boxes we know, with a fair amount of certainty, that rich discoveries are likely to be made. This has been the case in British Columbia, and such discoveries of ledges and veins, of quartz and minerals as above were made in many localities shortly after the discovery of the placer deposits, and though such finds, from the remoteness of the localities have, up to the present time, not been tested, still they are valuable and interesting as indications of future developments which are bound to come.

As may be noticed in every case, almost without exception, where placer deposits have been worked, promising ledges and veins have been discovered, and this over a mountain district extending from the International Boundary on the south, to the Youkon River and beyond in the north, a distance of over 1,400 miles, and there is little reason to doubt but that as the country becomes opened up, the mineral deposits of this vast region will become extremely valuable.

I purpose for convenience to divide this region into districts as follows :—*Southern*, *Cherry Creek*, *Kamloops*, *Yale*, *Kootenay*, *Lillooet*, *Cariboo*, *Omenica*, *Cassiar*, and to give brief notices of each. In some of these districts, from their accessibility, or from other favoring circumstances, more development work has been done than in others; such localities I propose to treat more in detail, not because they are likely to prove richer, but simply because in such cases results may be submitted to you.

In the *Southern Division* I include all that country to the south and in the vicinity of Okanagon Lake. In this district a great number of promising locations have been made at the following camps and places:—

Camp McKenney, about 12 miles from the placer mines on Rock Creek, and not far from the boundary. A working test from a quantity of ore sent to San Francisco from these mines gave returns in gold of $62.00 to the ton.

Camp Fairview, on Okanagon River.
Copper Camp.
Boundary Creek.
North Fork of Kettle River.
Tulemeen River.
Wolfe Creek.
Keremeos.
Amelia.
Maple Leaf.
Bear Creek.
Toad Colley.
Newton District, near Granite Creek.

In all of these localities promising ledges have been discovered, and a considerable amount of development work done with satisfactory results so far as they go, but the district is out of the regular line of travel, and the mines are not being developed as they would be were the country made more accessible by the building of railroads or waggon roads.

Cherry Creek Division.—In this locality we find two ledges upon which a considerable amount of work has been done. One is silver bearing, and crosses Cherry Creek near the placer mines. Assays from this mine show it to be extremely rich, one made by myself yielding 1205 ounces of silver to the ton, and a working test from two tons of ore sent to San Francisco giving 625 ounces to the ton. The other ledge, known as the McIntyre ledge, is situated about 12 miles further on, on Monashee Mountain, and shows gold visible to the naked eye. A quartz mill has been erected at this mine, and both localities reached by a good waggon road.

Kamloops Division includes the Nicola Mines and those claims situated at Jameson Creek and vicinity, and elsewhere on the North Thompson River.

The Nicola Mines are situated about 30 miles south of Kamloops, in the vicinity of Stump Lake, and on Idaho Mountain. A good waggon road connects them with the above place. The principal mine owners are as follows:—

Nicola Mining and Milling Company (English Capital).
Star Mining Co., Patterson & Henderson.
Mary Reynolds Co.
Wright & Fletcher.
Silver King Mining Co., and others.

A company was formed about 1882 to prospect these claims. About 1886 they sold out to the Nicola Mining and Milling Co., an English syndicate, who have expended a large amount of money in a systematic and business-like manner, principally on three of their claims, known as the King William, Joshua, and Tubal Cain, which claims the company are testing thoroughly preparatory to erecting extensive reduction works. These mines deserve special mention, for the amount of work done by this company far exceeds that done by any other company in the province. They employ a large force of men, are using improved machinery, have run, including drifts and shafts, up to 1890, some 3400 feet, and the future of the camp as a whole depends to a great extent upon their developments, with which they have so far been well satisfied.

The *Star Mining Company* have also done a considerable amount of work on their claims, and have also erected a small concentrating plant, and shipped some 16 tons of ore to San Francisco, yielding $75 per ton.

Other mine owners, as above, have also prospected their claims, and are well satisfied with the results. The principal minerals are lead, sulphides and carbonates, rich in silver, and also carrying a percentage of gold.

Many claims have also been located in the vicinity of Jameson Creek, which, from surface indications, promise well, as do other claims located further up the North Thompson and Clear Water Rivers. But as yet little development work has been done to prove the future use of these claims.

Yale Division.—By this is meant that section of country in the vicinity of Yale, Hope, North Bend, and Siwash Creek. In this division a number of claims have been developed to a considerable extent. Some of them are known to be rich, such, for instance, as those south of Hope, which have been known for a number of years, and upon which difficulties regarding ownership have prevented development.

The ore on two of these claims, known as Eureka and Van Bremer, is described as being principally argentiferous grey copper and silver chloride, and assays varying from $25.00 to $2,400 to the ton in silver are obtained. Promising indications are also obtained from other claims, but, as in other localities, lack of means prevents development.

Kootenay Division is traversed by the Canadian Pacific Railway, and important water stretches, such as the Columbia and Kootenay Rivers and Lakes, also exist, so that prospectors have been able to travel about in the mountains, and the result of their labor is shown by the large number of rich and promising ledges discovered in the following localities:—

Illecillewaet,
Field,
Fish Creek,
North Arm of Arrow Lake,
Toad Mountain,
Eagle Creek,
Hot Springs,
Hendryx Mines,
Spillemcheen Mountain,
Jubilee Mountain,
McMurdo District.
Deception Creek,
Windermere,
Big Bend,
Bugaboo Creek,
Horse Thief Creek,
Toby Creek,
Otter Tail,
Findlay Creek,
Copper Creek,
Bull River.

Of these localities I can only speak briefly, referring more particularly to those which have developed to the greatest extent.

The *Illicillewaet Mines* are situated near the station of that name on the Canadian Pacific Railway, and are within a short distance of the track. The Selkirk Mining and Smelting Company own a number of claims, and have erected sampling works, offices, boarding houses, etc., and have also built roads to their mines. They shipped, in 1887, some 300 tons of ore to smelting works in Omaha, the average value being 70 ounces of silver and 44% of lead to the ton. This company is now confining itself chiefly to developments in the Lanark Mine.

Corbin & Co. also own a number of valuable claims, upon which they have expended a large amount of money in developments. Mr. McKinnon holds the Maple Leaf Mine, adjoining the Lanark, at $80,000. Claims at Cariboo Creek are said to be equally rich.

At the *Field Mines*, close to the Canadian Pacific Railway station Field, a large amount of development work has been done; ore houses, offices, etc., having been built, also a tramway along the vein and down to the railway track. They have shipped a large amount of ore to smelting works. The ore is lead carbonate, and a low grade, but as it is easily smelted, and conveniently situated on the railway, the mines are certainly valuable. To the other localities, I can give only passing notice, confining myself mainly to giving working tests on shipments of ore made from various mines.

At McMurdo's we find galena ores, rich in silver, and apparently in well defined veins. Two car loads of ore shipped from the Wells, Pollock, and Aylmer property averaged 100 ounces of silver and 63% of lead to the ton.

There is also a well defined gold belt which is said to average about $20.00 to the ton. A stamp mill is now at Golden awaiting shipment in the spring to this field.

The *Spillemcheen and Jubilee* districts also promise well, and are conveniently situated near the Columbia River. The ore bodies are enormous, and are chiefly sulphides of copper and lead, which, however, are of a low grade character.

The *Hot Springs* are situated on Kootenay Lake, about 30 miles from Nelson. The parallel lodes exist in tiers on the mountain side, the lower ones being low grade galenas, which become richer as the mountain is ascended till the summit lodes are reached, where we find rich carbonates and sulphides of lead containing Wire and Ruby Silver.

Hendryx Mines are just on the opposite side of the lake from Hot Springs. Development work is being vigorously pushed on by means of an Ingersoll drill. The lode is said to be a mass of galena, 86 feet wide, which assays about 20 ounces of silver and 23% of lead to the ton. Perhaps the best way to convey an idea of the richness of these claims is to give the following milling tests from various mines in 1889:—

No. 1 claim ..	146 tons,	87 ounces of silver per ton.			
Little Donald.	85 “	90 “	silver	35% lead	per ton.
Silver King ..	40 “	299 “	“	20% cop’er	“
“ ..	30 “	230 “	“	20% “	“
Spokane	65 “	40 “	“	70% lead	“
Delia	20 “	120 “	“	....	“
Skyline	15 “	225 “	“	....	“
Gallagher ...	14 “	119 “	“	$14 in gold	“
Krao	12 “	95 “	“	50% lead	“

Or altogether 427 tons, yielding 50,393 ounces of silver.

Big Bend Mines are situated on the bend of the Columbia River, and are gold bearing, though galena is also found. From the richness of the placer deposits, there is every reason to suppose that they may be valuable. But as the region is inaccessible, and as little development work has been done, it is impossible to say much about their future. For the same reason little can be said about the other localities mentioned in the list, excepting that good assays are obtained and the surface prospects are promising.

Lillooet Division.—In this division the principal discoveries have been made in the vicinity of Cayoosh Creek, where a great number of claims have been staked off. The ledges are gold bearing, and the gold seems to be uniformly distributed through the quartz in a fine condition, as colors can be obtained almost everywhere. The average assay value is said to be about one ounce to the ton. These veins are undoubtedly the sources from which the rich placer deposits of this locality obtained their gold, and there is therefore a strong probability that they will prove remunerative in the future. Ledges have also been discovered in the vicinity of Seaton and Anderson Lakes, that at Anderson Lake being described as a strong lode of quartz carrying galena assaying $46.00 in silver and $14.00 in gold to the ton. In a few of these claims a considerable amount of prospecting work has been done, but in the great majority we find nothing beyond assessment work.

Cariboo Division, from the richness of its placer deposits worked in early days, has always been looked upon as a locality from which much in the way of developments in quartz might reasonably be expected. Many ledges were known even in these early days, from which in several instances $3.00 to $5.00 a day per man was made by washing the decomposed and oxidised rock matter at the surface of the veins. We accordingly find that in 1877-8, companies were found to operate mines here; but from exaggerated ideas of the richness and erroneous views regarding the methods and cost of working the ores, these efforts failed, and quartz mining received a severe check. Within the last few years, however, attention has been again turned to these ledges with what now appears to be a fair chance of success. From what is known of the district, it is clear that a great number of well defined quartz ledges exist, from which good prospects are obtained. As is well known, much of the gold obtained from quartz is contained in sulphurets, which on the surface has become oxidised, allowing the free gold to escape, and on several of the veins such bodies of sulphurets have been discovered. The government has established a small testing plant in this neighborhood, to assist the development of the mines, and several small stamp mills have also been erected. From the Black Jack Mine, two lots of ore have been worked as follows: No. 1 of 100 tons yielded $523.00 in free gold and 12 tons in sulphurets, worth $24.00 to the ton; No. 2 of 202 tons, yielding $4.50 in free gold and $13.00 in sulphurets per ton. By means of these stamp mills and testing works, the miners will be able to realize from their ores, and thus obtain money to go on with development of their mines, and there is every hope that in a short time they may be able to prove the value of their own claims, and with them assure success in quartz mining in the district as a whole.

Omenica Division.—The remote situation of this district will for the present prevent the development of vein mining, but there is no doubt that it is rich in minerals. Its placer deposits would seem to indicate the existence of both gold and silver bearing ledges. On Vital Creek, $\frac{1}{10}$ of the metal found was arquerite or silver amalgam. A large number of ledges containing highly argentiferous galena ore in large bodies are also known to exist, which assay from 30 to 130 ounces of silver to the ton. A number of these claims were at one time taken up, but have since been abandoned. When taken in connection with discoveries in more accessible regions, the probability is that nothing will be done to develop this district till it can be reached in a more convenient manner than it now is.

Cassiar Division.—Almost the same remarks may be applied to this district, in which many well defined ledges are known to exist, on which surface indications are promising, and from some of which rich assays have been obtained, indicating in connection with the rich placers which have been worked that the district in the future will become valuable from the mineral deposits in its veins and ledges. As regards its situation it could be made accessible with a comparatively small outlay.

The vast *Youkon District* to the north is apparently equally rich in mineral deposits.

In addition to the minerals enumerated above, many others are also to be found, such as molybdenum, mercury, antimony, plumbago, bitumen, asbestos, mica, platinum, coal and iron.

The *platinum* is found associated with the gold in placer mining in many localities throughout the province; but its principal source is Granite Creek, where, since 1885, some 4,000 ounces have been collected. It is the most important field for this mineral which has been discovered in North America.

The deposits of *coal* in the province, as is well known, are of vast importance. The mines on Vancouver Island were mined before the discovery of gold in the province. They are important, both from their extent, quality and favorable position. The output for 1889, from the various mines in operation, were as follows:—

	Tons.
Nanaimo Colliery	223,870
Wellington Colliery..................	273,383
East Wellington Colliery	51,372
Union Colliery.........	31,204
Total tons	579,929

The total output of coal for the Province, up to the end of 1888, was 4,358,221 tons.

These coals are of cretaceous formations, and they are now admitted to be superior to any other coals on the Pacific Coast.

In addition to the above, we find tertiary deposits scattered throughout the Province, both along the coast and in the interior. The tertiary area in British Columbia is estimated to be 12,000 square miles.

Deposits of iron also occur in many places in British Columbia. At present only such as are situated on the coast are available; but, as the country becomes developed, the others will also be valuable. In some cases they occur as clay ironstone in the coal series; but principally in the form of magnetites. Little attention, as yet, has been devoted to this branch of mining. The only ores being worked are those of Texada Island, which is magnetite of excellent quality. The mines are most favorably situated, either for shipment or smelting, as the Comox coal fields are only about twenty miles distant. The following shipments have been made: 1885, 190 tons; 1886, 3,941 tons; 1887, 1,410 tons; 1888, 7,300 tons. Similar deposits occur elsewhere along the coast, also favorably situated as regards shipment.

As may be seen from the foregoing, the Province possesses important mineral deposits in many different localities, and extending over a vast extent of country. It may very reasonably be asked, then, how so little has been done towards the development and working of these deposits?

Want of capital and the inaccessibility of the country have been and still are, the principal reasons. The completion of the Canadian Pacific Railway has opened the Kootenay District, and witness the developments and discoveries which have been made since that time. The discoverers, almost without exception, are poor men, and development of quartz mines requires capital; for, in most cases no returns can be obtained, even when valuable ore is lying in the dump: the great hope, then, is that moneyed men may be induced to invest and help in the development. In many cases the miners are themselves to blame—they give exaggerated values to their properties, based upon fictitious results obtained from picked assays, or hold undeveloped property at fabulous prices. This is more likely to do harm than good, and is bound to delay developments. Average results are what are required, and if these can be obtained from a quantity of ore, they give undoubted proof as to the value of the mines. But, in the absence of capital, these working tests can only be obtained under favorable circumstances, both as regards situation and richness of ore, which has usually to be packed for long distances to the nearest shipping points. Low grade ores cannot be tested in this way, except when reduction works are near, even though such deposits are equally as valuable as the richer ores. The following examples will give an idea of the present cost of shipping ore from mines which are favorably situated: Silver King Mine, Toad Mountain to Nelson, a distance of seven miles, by pack train, $10 per ton, and from there to Butte, Montana, including smelting, $47 per ton; in all, $57 per ton. The cost of transportation from Hot Springs to the same destination, including smelting charges, $40 per ton. This does not include the cost of packing from the mine to the water edge, which, of course, varies with the distance. The erection of such reduction works in the Province, then, is of great importance: First, because it allows miners to receive some returns from their ore, and thus aids them in going on with development; Second, the erection of such works by experienced men is a direct proof that the importance of the deposits is recognized. It is not out of place, therefore, to show what has been done in this way.

In the Cariboo District, stamp mills have been erected as follows:—

Island Mountain Mining Company—One ten-stamp mill, operated by a fifty-horse-power engine, with the view of working a larger number stamps as required.

British Columbia Mining and Milling Company, Stout's Gulch—One ten-stamp mill and engine (on the ground, but not erected).

Black Jack Quartz Mining Company—A one-stamp test mill, capable of working 1½ tons of ore per day, operated by water.

Nason & Co., Conklin's Gulch—One four-stamp mill, worked by water.

In addition to the above, the Government, with the view of encouraging and assisting the miners, has erected a small testing and chlorinating plant, with a capacity of about three tons per day.

NEW WESTMINSTER DISTRICT.

At Vancouver a smelter and sampling works, with a capacity of 50 tons per day. Through some faults in construction, not working at present.

KOOTENAY DISTRICT.

At Golden, a smelter, 20 tons capacity per day, with roasting furnace, 14 tons capacity per day.

At Revelstoke, a smelter, owned by the Revelstoke Smelting Syndicate, capacity 60 tons per day; also, sampling works, having a capacity of 100 tons per day, operated by a fifty-horse-power engine.

At Summit of Toad Mountain, the Collingwood Gold Mining Company has two Huntingdon Mills of five tons capacity each, and two Frue vanning concentrators.

At Eagle Creek, one ten-stamp mill and four Frue vanners, capacity 15 tons per day, operated by a Pelton water wheel.

A stamp mill now at Golden, awaiting shipment to mines in the spring. Its capacity I am unable to give.

In addition to the working tests already given, some 205 tons of ore were also tested, yielding 69,530 ounces of silver; or, say, on an average, 340 ounces of silver to the ton.

In many of the localities the success of the camp, as a whole, depends to a great extent upon the successful development perhaps of single claims, where owners are more fortunate as regards capital and means to prove the value of their claims.

Another reason which has retarded actual working developments and erection of reduction works, is the fact that a large amount of preliminary work is necessary, both to ensure a constant supply of ore, and also to determine the methods by which it is to be worked, for in many cases the character of the ore changes after a certain depth is reached. As the coarse gold of the placer deposits is derived from ledges in the immediate vicinity, we might fairly assume that these ledges would be gold-bearing. If this were the case it would simplify matters considerably, and at the same time materially assist in the immediate development of mines throughout the Province, for ores, if free milling, are worked by machinery—inexpensive when compared with the cost of reduction works required for the treatment of silver ores when associated with the baser metals. When a portion of the ledges is destroyed, the gold, from the fact that it is acted upon by few agents in nature, is left, while the more alterable associated minerals, copper, lead etc., are destroyed and carried away. In this way, in many cases, the gold of the placer deposits may be robbed from ledges which will in all probability turn out in many cases to be silver-bearing, the principal associated minerals being copper and lead, with the probability that silver-bearing copper ores will be more plentiful than silver-bearing lead ores, though surface indications show the latter more abundant.

Next in importance to the mines themselves are the ways and means of reaching them.

The Columbia and Kootenay Railway is now under construction, and will, I am told, be ready to carry ores next summer. If so, in connection with steamboats now built and operated on the Columbia River, miners will be enabled to ship ores direct to the smelters at Revelstoke and Golden, at a comparatively small cost, and there is no reason to doubt that these smelters will be kept steadily at work, and in a short time prove inadequate to treat the amount of ore coming in. In the Kootenay District at least, then, we may look forward to important developments in a very short time. Elsewhere throughout the country railroads, waggon roads, etc., for reaching the mines, are badly required.

This paper has assumed dimensions far beyond what I had intended. It has been impossible to mention individual claims, except where, from more important developments, I have been warranted in doing so. You will therefore understand that this has been avoided, not because they were unworthy of mention, but simply because space will not allow me to give it. From the accessibility of the Kootenay District I have given it more space and attention, probably at the expense of other districts equally as promising and valuable, but at present not so favorably situated. This is simply because, in this district, as a whole, more developments have been made, affording me more tangible proof to present to you.

Mining in British Columbia has now reached that stage when examination of its mines is courted and invited. Let us hope, then, that with the completion of the Canadian Pacific Railway, and improved facilities for travel, capitalists will visit the country and judge for themselves.

Let me state, in conclusion, that the existence of rich, valuable and extensive mineral deposits within the boundaries of British Columbia, is now admitted, and that it is only a question of a short time till this will be definitely proved. The development and working of these deposits will create a vast and permanent industry, supporting a large population. Important towns and mining centres will spring up at various points; railroads will be built; and British Columbia, I venture to say, will become one of the richest, if not the richest, and most valuable province of our Dominion of Canada.

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Cost of Sinkings for Coal.

(Colliery Guardian).

Estimated cost of sinking two shafts of 14 ft. diameter each, 120 ft. apart. Depth to the main seam 410 yards from the surface. No. 1 is the engine shaft; the sinking in it is kept in advance of No. 2, chiefly on account of draining the latter.

The sinking of shafts is usually taken under contract prices, and a specification by a professional man, who, besides giving advice, provides experienced men for sinking, walling, putting in tubbing, wedging cribs, putting in and changing pumps, etc. Besides personal superintendence, his men from long experience would perform the work more systematically than others, and in consequence with more economy and expedition, especially when technical difficulties occur. The changing of rods and pumps for sinking and standing sets (depending so much on the quantity of water met with) and the cost of materials are not included in contracts, but sinking gear, kibbles, trams, running platforms, and similar appliances might with advantage be found by the contractor.

NO. 1 SHAFT.

	£	s.	d.	£	s.	d.
Temporary headgear, pulleys, and gin				90	0	0
Temporary smiths' and joiners' shop, sinkers' lodge, and storehouse				150	0	0
Sinking to the stone-head in clay 30 yards, at £6				180	0	0
Sinking 380 yards in coal measures to the main seam, at £7 10s. per yard				2,850	0	0
Sinking 10 yards further for sump, at £7 10.				75	0	0
30 yards of cribs, 1 in. backing deals, props, and stringing deals through the clay, at £3 10s				105	0	0
30 yards of walling in the clay, including walling crib, at £5 10s				165	0	0
30 yards of temporary cribs and backing deals where the stone is weak, at £3 10s.				105	0	0
150 yards of walling in the coal measures, at £6				900	0	0
120 yards of cast iron tubbing, including backing, wedging, and sheathing, at £24				2,880	0	0
Six wedging cribs, 60 cwt. each, at 7s. 6d., putting in £6 each				171	0	0
430 yards of main brattice, including labour in fixing, at 35s				752	10	0
Four cast iron ring cribs, including fixing				50	0	0
Main and tail crabs £120, ground crabs £80, cradle crab £40, and two gins £80				320	0	0
Engine for drawing stones				440	0	0
Main crab rope 12 in., ground crab rope 7 in., gin ropes 5½ in., cradle rope 8½ in., and machine ropes during sinking				1,600	0	0
80 in. main engine, condensing, and boilers	4,600	0	0			
House for engine, boiler seats, chimney, and woodwork in the house	1,400	0	0			
				6,000	0	0
Permanent winding engine, 100 horse power, and boilers	1,980	0	0			
Engine house, boiler seats, chimney and woodwork in house	1,300	0	0			
				3,280	0	0
Two pairs of flat ropes, 120 and 240 fathoms, = 156 cwt., at 42s				327	0	0
Counterbalance apparatus for winding engine, including rope, chain, and 40 yards of staple	320	0	0			
One pulley, 12 cwt., at 10s	6	0	0			
				326	0	0
Shear legs for pump shaft	140	0	0			
Sheaves for crabs and gins, with axles	50	0	0			
Shaft frame of wood	160	0	0			
Two 10 ft. pulleys, 33 cwt., at 10s	16	10	0			
Axles for pulleys, 3 cwt. at 36s.	5	8	0			
Labour in erection	20	0	0			
				391	18	0

There are four lifts of pumps, the three upper are forcing lifts, each 120 yards in length, 15 in. rams, the lower a lifting set from the bottom of sump, its length is 60 yards, 15 in. bucket. As the water will be raised from the bottom only, the capacity of the pumps is the same in each lift.

	£	s.	d.	£	s.	d.
The first set of pumps at the top—						
Snorehole pipe, 19 cwt. at 11s	10	9	0			
H-piece, bored, clack seat and doors 48 cwt., at 11s	26	8	0			
Chamber for ram and gland, bored, 30 cwt., at 15s	22	10	0			
Ram gland, turned, 22 cwt. at 15s	16	10	0			
15 in. hoop for ram, 49 lb. at 4½d	0	18	0			
Brass bushes for ram, bored, 197 lb. at 2s	19	14	0			
2 clacks, turned, 2½ cwt. at 20s	2	10	0			
Bolts, clack falls and shackles, 660 lb. at 4d	11	0	0			
31 cast iron pumps, 19 cwt. = 589 cwt. at 7s	206	3	0			
Bunton for set to stand on	40	0	0			
Cistern at top of the set, 15 cwt. at 20s	15	0	0			
Labour, fitting up ram, clacks, etc	15	0	0			
				386	2	0
Second set of pumps, same as first				386	2	0
Third set of pumps, same as first				386	2	0
Fourth set, lifting from the sump—						
Snorehole pipe, 19 cwt. at 11s.	10	9	0			
15 in. working barrel, bored, 30 cwt. at 16s	24	0	0			
Two Y-plates and box, bolts and nuts, each 850 lb. at 5d.	35	8	4			
Bucket and clack pieces, 58 cwt. at 11s	31	18	0			
15 cast iron pumps, 19 cwt. each, 285 cwt. at 7s	99	15	0			
Buckets and clacks, 6 cwt. at 28s	8	8	0			
Doors, cross bars, swords and keys	5	10	0			
4 clack bows, 1 cwt. each, 448 lb. at 5d	9	6	8			
3 hoops for buckets, 90 lb. at 10d	3	15	0			
Wood buntons for set to stand on	13	0	0			
				241	10	0
Sundries.—Sinking gear, £66; drawing sets, putting pumps in, £240; flannel for sinkers, £100; clacks and buckets, bolts, iron, nails, rope, &c., £594				1,000	0	0
1,080 ft. of Memel rods, 12 in. square, for forcing sets, including dressing, at 3s	162	0	0			
60 ft. ditto, low set, 6½ in., at 3s	9	0	0			
Ground spears, 6 in. square	45	0	0			
Spear plates, 18 pairs, 31 cwt., at 20s	31	0	0			
Sheaves, sheave cases, bottom rods for ground set, bolts and clams	72	0	0			
Collarings for pumps and rods, bolts and scaffolds at doors.	58	0	0			
Water-boxes, deal, including putting in boxes, nails and spikes, 150 yards at 2s. 6d.	18	15	0			
Rod plates for the forcing sets, 104 cwt., at 22s	114	8	0			
Bolts and nuts for plates, 39 cwt., at 37s. 4d	72	16	0			
Plates for the lifting rods, 15 cwt., at 22s	16	10	0			
Bottom rods for four sets, 38 cwt., at 38s	72	4	0			
				671	13	0

Enginemen and firemen at the engines, smith, grather; oil, tallow, leather, &c., = £20 per week. At 4 yards sinking per week is £5 per yard; 400 yards at £5				2,000	0	0
Cutting out balance-beam chamber at 300 yards depth, 36 ft. × 12 ft. × 18 ft. high = 288 cubic yards at 7s	100	16	0			
Masonry, walling and arching.	79	0	0			
Cast iron beam of 8 tons, at £12	96	0	0			
Balance-box and weights, 30 tons, at £4	120	0	0			
Gudgeons and pins, carriages and bolts	90	0	0			
Connecting straps to main rod, £24, paralled motion and straps, £70	94	0	0			
				579	16	0
Under level drift from the bottom of sump to the dip workings, 130 yards, at 30s.	195	0	0			
Arching the drift, 130 yards, at 12s. 6d	81	5	0			
				276	5	0
Shaft fittings, including buntons, guides and labor, 420 yards, at 30s				630	0	0
Three cages				54	0	0
120 wood tubs, 8 cwt. capacity, at £3 each.				360	0	0
Rails				260	0	0
Metal plates for top and bottom of the shaft, 4 tons at £5 10s				22	0	0
Pit-frame, 4 coal screens, small coal apparatus and walling for heapstead				1,200	0	0
120 chaldron wagons, at £16 each				1,920	0	0
Cost of coal, including railway charge during sinking operations				990	0	0
Other railway charges				110	0	0
Reservoir for engine water, 120 × 90 ft. and 6 ft. deep = 2,400 cubic yards, at 9d.				90	0	0
Drifts, pipes, masonry, and securing the sides of pond				80	0	0
Four horses—purchase price, £40 each	160	0	0			
Keep for three years, at £42 per year	504	0	0			
Gears	40	0	0			
3 carts £40, 1 wagon £22	62	0	0			
3 men's wages, and 3 laborers' during sinking	780	0	0			
				1,546	0	0
1 smith and 2 joiners' wages, three years				499	4	0
Smiths' shop, 60 × 26 ft.; joiners' shop same; fitting shop, 60 × 26 ft.; and storehouse 26 ft. square				580	0	0
Engine, 10-horse power, for driving saw mill, lathes, &c				200	0	0
Saw mill, boiler, chimney and engine house.				280	0	0
Bellows £45, anvils £24, smiths' tools £60, vices £22				141	0	0
Lathes, fitting tools, joiners' benches				300	0	0
Yard wall and gates				98	0	0
Office and furniture £100, and 2 agents' houses £400				500	0	0
8-stalled stable, granary above				260	0	0
40 workmen's cottages at £60				2,400	0	0
Damaged ground rent, 3 years at £60				180	0	0
Agency during sinking —						
Cashier	150	0	0			
Viewer	150	0	0			
Enginewright	100	0	0			
				400	0	0
Cost of No. 1 shaft				£40,186	2	0

No. 2 Shaft.

The sinking of No. 2 shaft is estimated to be done without the use of pumps. In place of this a drift will be driven from the engine pit, and a borehole put down to meet it at the required level.

				£.	s.	d.
Temporary headgear, pulleys and gin				90	0	0
Sinking to the stone head in clay, 30 yards at £6				180	0	0
Sinking 380 yards in coal measures to the main seam, at £7 10s. per yard				2,850	0	0
Sinking 10 yards further for sump, at £7 10s				75	0	0
60 yards of temporary cribs for securing shaft in clay and in weak stone, including backing, stringing deals, and props, at £3 10s				210	0	0
30 yards of walling in the clay, including walling crib, and taking out cribs and deals, at £5 10s				165	0	0
150 yards of walling in coal measures, at £6				900	0	0
120 yards of cast iron tubbing, including sheathing, backing, and wedging, at £24.				2,880	0	0
6 wedging cribs, 60 cwt. each, at 7s. 6d., and putting in at £6 each				171	0	0
Four cast iron ring cribs, including fixing				50	0	0
Temporary brattice, 120 yards, at 18s				108	0	0
Engine for drawing stones				440	0	0
Permanent winding engine, 100-horse power, and boilers				1,980	0	0
Engine house and woodwork, boiler seats and chimney				1,300	0	0
Two pairs of flat ropes, 120 and 240 fathoms, = 156 cwt., at 42s				327	12	0
	£	s.	d.			
Counterbalance apparatus for the winding engine, including rope, chain, and 40 yards of staple	320	0	0			
One pulley, 12 cwt., at 10s.	6	0	0			
				326	0	0
Headgear of wood £160, erecting £20	180	0	0			
Two 10 ft. pulleys, 33 cwt., at 10s.; axles, 3 cwt., at 36s.	21	18	0			
				201	18	0
Drivings in coal between the shafts for ventilation, 141 yards, at 10s				70	10	0
Driving drift between the shafts in stone, 36 yards, 4 ft. wide, 5 ft. high, at 30s. per yard	54	0	0			
Boring to the drift from bottom of No. 2 pit, to run water into the engine shaft at second set	120	0	0			
				174	0	0
Sundries: Sinking gear £80, boring gear £30, flannel for sinkers, £70, iron, nails, rope, etc., £350				530	0	0
Enginemen and firemen at the engines and stores				620	0	0
Cradle crab £40, cradle rope, 8½ in., 36 cwt., at 42s. = £75 12s., two sheaves £6 10s				122	2	0
Shaft fittings; including buntons, guides, and labour, 420 yards, at 30s				630	0	0
3 cages				54	0	0
120 tubs of wood, 8 cwt. capacity, at £3				360	0	0
Rails, underground				260	0	0
Metal plates for top and bottom of the shaft, 4 tons, at £5 10s				22	0	0
Pit frame, 4 coal screens, small coal apparatus, and walling for heapstead				1,200	0	0
120 chaldron wagons, at £16 each				1,920	0	0
Cost of coal, including carriage, during sinking				690	0	0
Railway charge for materials				70	0	0
Sidings on the surface for the colliery				660	0	0
Damaged ground rent				180	0	0
Cost of No. 2 shaft				19,817	2	0
Cost of No. 1 shaft				40,186	2	0
Total cost of the shafts				60,003	4	0

Mine rents are not included in the cost of sinking; the payment of certain rents should be deferred for two or more years; a reasonable time being allowed for sinking, according to circumstances.

Second Annual Meeting of the Asbestus Club, Black Lake.

The second annual meeting of the Asbestus Club was held in their rooms at Black Lake, Que., on the 9th inst., Mr. L. A. Klein in the chair. The minutes of the last meeting were read and confirmed and the following new members elected: Messrs. T. H. Crabtree, John Hammer, J. M. Johnston; Mr. Edgar Ingram of Montreal was also accepted. It was decided that the by-laws of the club should be altered so as to permit of two vice-presidents and seven councillors holding office, and also that the regular monthly meetings be held in Black Lake and Thetford. The election of officers for the ensuing year was then proceeded with, resulting as under:—

President—L. J. Frechette, M.P.
Vice-presidents—M. Penhale, Black Lake; A. Ward, Thetford.
Secretary-treasurer—A. M. Evans, M.E., Black Lake.
Assistant secretary-treasurer—Robert Strather.

COUNCIL.

L. A. Klein, chairman,	American Asbestus Co.
Thos. Sheridan,	Bell's Asbestus Co.
R. T. Hopper,	Anglo-Canadian Asbestus Co.
Col. Ward,	Ross, Ward & Co.
J. J. Penhale,	United Asbestus Co.
H. J. Williams,	Beaver Asbestus Co.
Ben. Bennett,	King Bros.

The twelve regular meetings to be held on the last Thursday of each month; other meetings, subject to call, to be held at Black Lake.

The accommodation of the Club House was then discussed. It was thought by a majority of the members present that the present location was a little out of the way and rather inconvenient, and a committee consisting of Messrs. M. Penhale, L. A. Klein and A. M. Evans, was therefore appointed to report at the next general meeting on the selection of rooms better adapted for the general convenience of the club.

The question of a telephone service between Thetford and Black Lake, with a view to securing connection with Sherbrooke, was next taken up, but in the absence of a representative of the Sherbrooke Telephone Association, and Dr. La Rose of St. Julie, matters were postponed until a called meeting, which will be at an early date.

A hearty vote of thanks was then passed to the retiring officers for their services of the past year, and the meeting adjourned.

The members of the club are determined that its possibilities shall be in every way developed and realized this year. All that is needed is the hearty co-operation of the Thetford and Black Lake mining men. With the growing mining interests of the district there is no reason why the Asbestus Club, properly managed, should not become a power in the land. It is the intention of the club to secure men of known ability to deliver lectures on mining and social matters during the coming twelve months. The first meeting of the second year will be held in Thetford on the 28th instant, when a paper will be read by Mr. H. J. Williams on "First Impressions of the Electric Drill;" this paper will no doubt be of a very interesting character.

Uses of Feldspar.

The use of feldspar in pottery depends upon the fact that it will fuse at a very high temperature. The best porcelain consists of a mixture of infusible clay and feldspar; by subjecting this to very powerful heat the feldspar fuses, and forms a cement for the clay. When feldspar is used in this way it is said to form a part of the "body" of ware. The amount of feldspar so mixed with the body of porcelain is only sufficient to hold the clay firmly together. The mass is porous, and requires a smooth coating of some fusible substance called a "glaze." The best substance for such a glaze is feldspar, because it forms a smooth surface which is very hard, and resists the action of all substances exceedingly well. It is used as the glaze for the best kinds of porcelain, such as that made at Sévres. It would be used generally except for the high temperature necessary for its fusion, and there are many other kinds of glaze that will fuse more readily. Feldspar is used in less quantity than any other constituent of pottery, particularly in this country, and the proportion varies according to the exact nature of the clay employed. The proportion used by each manufacturer depends upon some recipe which he has found most suitable for the temperature and other conditions under which he works. Besides the use in porcelain manufacture, feldspar is also used in more common grades of pottery, and here also a manufacturer always clings to some arbitrary proportion which he has found valuable. With the present increasing tendency to manufacture better grades of pottery, as shown by the new kinds of porcelain made at Trenton, Baltimore, and Cincinnati, and the use of higher temperatures in these potteries, it seems probable that the consumption of feldspar will increase markedly within the next few years.

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Large Charcoal Blast Furnace.—The largest charcoal blast furnace on the Continent of Europe, has recently been blown in at Vayda-Hunyard, Hungary. Its annual capacity is about 15,000 tons.

CORRESPONDENCE.

The Analysis of Phosphates.

Sir: Supplementing the notes on the analysis of phosphates, which I had the pleasure of sending your Review some time ago, the following "*Alcohol Method*" for the determination of oxide of iron and alumina will perhaps be acceptable to many of your readers.

Phosphate sellers know too often to their regret how unsatisfactory are the results of the analyses for iron and alumina when made by different chemists who do not employ the same method of analysis. This "alcohol method" was first proposed by Eugene Glaser in 1889, and is sometimes termed "*Glaser's Method.*" It has been adopted by the German chemists, and is finding favor with the English chemists for the commercial analyses of phosphate fertilizers.

It would be well therefore to employ this method for phosphates to be sold in Europe on guarantee.

J. Lainson-Wills.

Ottawa, May 26th, 1891.

DETERMINATION OF FERRIC OXIDE AND ALUMINA IN PRESENCE OF PHOSPHORIC ACID BY THE ALCOHOL METHOD.

Five grms. phosphate are dissolved in the usual manner in 25 c.c. nitric acid of sp. gr. 1·2, and about 12·5 c.c. hydrochloric acid of the same sp. gr., and made up of 500 c.c.; 100 c.c. of the filtrate (one-fifth of the sample), are placed in a ¼-litre flask, with the addition of 25 c.c. sulphuric acid of 1·84 sp. gr. The flask is let stand for five minutes, shaking occasionally; about 100 c.c. alcohol (95 per cent.), are added; the flask is cooled, filled up to the mark with alcohol, and well shaken up. After standing for half an hour the liquid is filtered 100 c.c. of the filtrate (0·4 grm. of the sample), are evaporated down in a platinum capsule until the alcohol is expelled. The solution is then mixed with 50 c.c. water in a beaker and heated to a boil. Ammonia is added to the solution until the reaction is alkaline, but not whilst boiling, to avoid a violent effervescence. The excess of ammonia is boiled away; it is let cool, filtered, the precipitate washed with hot water, ignited, and weighed as ferric and aluminium phosphate. On trying this method the author obtained results which agree with those of calculation. The precipitate obtained was pure, consisting entirely of ferric and aluminium phosphates. This "alcohol method" was formally accepted at the Congress of German Experimental Stations, held on September 18th, 1891. (See Zeitschrift Anal. Chemie., xxx., p. 9).

MINING NOTES.

[FROM OUR CORRESPONDENTS.]

Newfoundland.

A new concern, the Pyrite Company (limited), has been incorporated in England, with a capital of £300,000, to work a property on the south-eastern part of Pelley's Island, Notre Dame Bay, Newfoundland, twenty miles from Little Bay and about two hundred and forty miles north-east of St. Johns. Steamers from New York make fortnightly calls at the island during the open season. In close proximity to the mines is a fine harbor, capable of holding a large fleet of vessels, channels to which are all buoyed from 7½ to 15 fathoms of water. The shipping season extends from about the beginning of May to the end of December. There is erected at the harbor, and within three hundred yards from the shafts—by which the mines are now being worked—a substantially built wharf, connected with the mines by a well equipped tramway, at which steamers of any capacity can be loaded. An addition is now being made to the wharf, and when this is completed it is claimed that 1,000 tons of ore can be put on board steamers in twenty-four hours. The lode which is being worked is a strong one, running east and west, and dipping south at an angle of forty-five degrees. It is composed of a solid mass of pyrites, varying in width from 50 feet at surface to 94 feet at No. 1 level, and at the No. 2 level to a discovered width of 123 feet. No. 3 level, at a depth along the foot wall of 248 feet, is not as yet greatly extended. The workings along the vein are about 500 feet in length, and the mining work which has been done on the property has laid open a very large extent of ore ready for extraction, which is estimated at about 500,000 tons. The ore is said to contain about 52% sulphur, and 46·80% of iron. It is proposed to put large air compressors and drills into these mines, along with extensive improvements which will greatly facilitate the handling of the ore and increase the output.

Nova Scotia.

Beaver Dam District.

The mill at this place is working continuously and satisfactorily. The mine is reported as being very wet, but as looking as well, if not better than usual.

Caribou District.

With the exception of the mine worked by Dixon & Co. there is very little doing here. The once famous Lake Lode is in a state of innocuous desuetude, and it is difficult to imagine its revival. Mr. Whidden is still in charge of the prospecting work of the Halifax Mining and Prospecting Company, and Messrs. McDonell & Co., have begun some work preliminary to opening up their property next month.

Fifteen Mile Stream.

The Egerton Company have received the second Matheson compound engine, which will be used to drive a belted Blake air compressor. The company have ordered four Sergeant rock drills, 2¾ inch air cylinder, from the Ingersoll Rock Drill Co. of Canada, and hope to get their new equipment in operation by mid-summer.

The clean up last month at the Egerton mine gave 200 ounces from about 350 tons of quartz crushed. Considerable additions are being made to the plant. Another ten stamps are being added to the fifteen already at work, and an air-compressor for the drills is being put in, together with a four-ton boiler and an additional compound engine of about forty horse-power for hoisting and pumping, leaving the other for the batteries. The deepest shaft is now down 200 feet. A new shaft is being opened on what is supposed to be the Serpent lode. Some fifty men are now employed, and the prospects for the season appear bright. It is intended to do some development work about the 1st of June.

On the Stanley property there is little or nothing doing, as they are waiting for the water to dry up. Two shafts are down about 90 feet and a good deal of tunnelling has been done, but at present the only work being done is in the ten-stamp mill, where they are doing custom crushing. About twenty men are employed. It is intended to prospect this year as soon as the weather permits.

Work is progressing on the old Hudson claim, under the management of Mr. M. G. McLeod, with a force of twelve men. Their quartz is crushed at the Stanley mill.

Darr's Hill District.

The returns from the Dufferin Gold Mining Co. for April were smaller than for some time, owing to the lack of miners, and consequent reduced output. The quartz obtained came chiefly from the north vein, which, at the present time, has a clear width of twenty-five feet. The western end of the South Lode is looking well, some very rich ore having been uncovered there.

Gay's River District.

During the last few weeks there has been a flood and ebb tide of prosperity here, and now comes the report that the Coldstream Company are to resume operations and once more make the district blossom as a rose. The official returns of the company have thus far shown a return of only 17¾ ounces from 210 tons, an average of $1\frac{7}{10}$ dwts. per ton, or about $1.61.

Some of the "know-all's" claim that this return does not represent the amount of gold present in the material milled, but that the new plates were "hungry" and absorbed an abnormal amount. As the amalgamator making the test-run was a man probably without a superior in the Province, and as the Gay's river gold is all, technically, speaking, "coarse" it is fair to assume that the sworn return above alluded to, represents the economic value of the material crushed. Whether a judicious sorting of material and selection of ground would materially raise this average can be answered only after making the test.

Stormont District.

The property of the North Star Co. is looking exceedingly well. The North Star lode maintains its size and yields in excess of one ounce to the ton. The Burke lode is also showing good ore. No hand drilling work is doing at present in the North Star, only the air drills are working. It is the intention of the company to add to its plant an additional compressor and four drills, and the manager, Mr. Fisher, is considering plans for a re-arrangement of the existing plant and the erection of a mill near the head of the main incline.

South Uniacke.

Messrs. Neily & Co. are still sinking and have faith in their prospects.

Messrs. Thompson and Quirk reached the streak in the new shaft the first of last month, and found the roll as good and as large as in their western workings. A yield of 276 ounces from 19 tons is reported.

The Witherow mine has also had a dividend the past two months, and is in good shape for an increased production.

Mount Uniacke District.

The Phœnix Co. are reported to have struck a high grade streak in their 360 ft. cross-cut. The best of lodes here is over 40 feet in width, and the quantity of low grade ore exposed is very large.

The property of the Montreal Co. here is under bond to a New York syndicate, and an examination of the mines will be made this month.

Waverley District.

The Sophia Gold Mining Co. is the name of the concern which is now operating the property of T. J. Wallace under a lease. Mr. Levy, the resident manager, has patched up the old Bürkner water mill, and has been crushing quartz coming from the "Nigger" lode, on the southern dip of the district. The returns from this lode have not been up to expectations nor reputation, and the lode is somewhat smaller going west. The company have started work preparatory to unwatering the Tudor lode.

Ground for the mill of the West Waverley Co. was broken on the 11th inst. This mill will be designed and erected for 20 stamps, but only 10 will be put in until the mine development warrants more. The shaft on the Union lode has been straightened for 225 feet, and re-timbered, and the skip track is laid ready for use. Active mining operations will be commenced in June.

Pictou County.

The New Glasgow Iron, Coal and Railway Company have commenced a branch line from Eureka to connect with their furnace at the forks of the East River, and with their mines at Springville. They have continued opening and testing their large and valuable properties.

Iron ore was mined by this company at Brookfield. Mr. R. G. Leckie, of Londonderry, tested a promising deposit near Pugwash, and discoveries were reported from various localities.

Cumberland County.

Operations have been steadily pursued by the Londonderry Iron Company, both at their mines and their furnaces. Calcining furnaces have been built, and large amounts of Spathic ore have been burned. This process greatly increases the per centage of iron in the ore, and makes it more fusible.

A very interesting event took place at the Londonderry Iron works on Saturday, April 25th. The new blast furnace which has been under construction for some months, was put in operation, the ceremony of "lighting up" devolving upon Miss Florence Leckie, daughter of Manager R. G. Leckie. As the torch was applied to the last tuyere hole, three cheers were given by the crowd assembled. Shortly after, the engines operating the blast were set going by Mrs. Perrin, wife of C. P. Perrin, under whose superintendence the construction and the operation of starting the furnace have been successfully conducted. The new furnace is seventy-five feet high and nineteen feet in diameter of bosh. It is expected the output of iron will reach 100 tons a day.

Cape Breton.

No. 3 shaft at the Coxheath Copper Mine is a perpendicular shaft sunk in the middle of a large surface ore, showing for the first 50 feet the shaft was in rich ore on all sides, the width of the vein not being determined. The latest advices from the mine state that at 53 feet in depth a strong foot wall has developed, dipping towards the north, to vein B; the ore which, for a few feet back, had been somewhat lean, has again improved in quality. The hanging wall has not yet been cut, showing the ore body to be one of considerable width.

A company is being incorporated with New York capital to ship ore from the Moseley leases at East Bay, Cape Breton. The ore is a red hematite, associated with Laurentian limestones, and so far as exploratory work has been carried, appears to be uniform in quality and to be present in quantity.

The sales of the Bras d'Or Lime Co. for last year are reported at 44,000 lbs., shipped mainly to Boston and New York.

The total coal sales for this county, officially reported, were 916,994 tons, against 751,997 tons in 1889, and 738,250 tons in 1888.

The home sales were 223,732 tons, compared with 200,182 tons during the preceding year.

The sales to Province of Quebec were 480,462 tons, against 381,074 tons in 1889.

The production and sales of the various Cape Breton collieries during the year 1890 were as follows :—

	Raised.	Sold.
Bridgeport	28,223 tons.	28,692 tons.
Caledonia	156,174 "	145,373 "
Franklyn	723 "	723 "
Glace Bay	111,472 "	108,490 "
Gowrie	141,099 "	124,641 "
International	143,091 "	133,076 "
Ontario	9,049 "	8,387 "
Reserve	155,906 "	139,777 "
Sydney	181,571 "	160,468 "
Victoria	90,930 "	77,367 "

The operations at the various collieries during last year are thus described by Mr. P. Neville, Deputy Inspector, in his report to the Commissioner of Mines :—

Gowrie Mines.—Work has been carried on in its usual way, levels extended on both sides of the low lift and rooms broken off. On No. 1 lift, west side, the levels have been driven about nine hundred feet parallel to the stone troubles; it is found, as they advance, that the coal is dipping slightly to the southwest, so that the course of the levels are now going more northerly, gaining more grip on the seam. The management say it is their intention this winter to drive through and come out on the opposite side of the basin. The slant road mentioned in last report on west side has been completed and gives good satisfaction. On bank a new tubular boiler of sixty horse power has been put in place, in addition to the others.

Ontario Mines.—During last winter pumps were placed below No. 1 level for the purpose of drying the dip workings. The water was lowered by the 10th of June a distance of 200 feet to No. 2 level, and up to the last of September it was lowered to No. 3 level, a distance in all of 460 feet. From that date the pumps seemed to be getting out of order and the water raising. Finally work ceased on the 31st of October and pumps and pipes removed to the surface. The coal mined here during the season was taken from No. 2 section, north side, between No. 1 and No. 2 levels. A few pillars have been drawn and split in No. 3, north side; also six rooms were worked at the face of the solid coal, below No. 1 level, south side.

Caledonia Mines.—Work has been brisk at this mine during the last season. The main deeps have been driven down 300 feet; No. 2 levels, above this, have been extended on the west and east sides, and rooms broke off and worked. A slant road has been driven from this east level coming out at the east side of the pit, for the purpose of drawing coal from that section. A small section of pillars have been drawn and split in the east side rise workings. A new double engine has been imported and placed on surface east of the hoisting shaft for the purpose of drawing the coal from the deeps. Also, preparations are being made to put a double furnace where the single one is now.

Little Glace Bay.—The operations at this colliery during the year have chiefly been the extension of rooms already gained and worked off the levels. The rooms south of the 1,800 foot headway have been worked, and some of them drawn up to the Harbor pit workings. In the month of June, as the weather became calm and warm, the air was found dull on the west side of the pit upper workings. The management erected a cupola over the old furnace shaft at the Harbor pit, in order to make an upcast there, and have two separate returns. This did well for a while, until the weather got cool and blowy; and as it was found, owing to the tenderness of the roof, too expensive to build a furnace there, it was abandoned and a steam jet placed at the bottom of the pump shaft. This, with the heated pipe to the Cameron pump, sufficed for the time being. However, I am glad to report that Mr. Rigby has ordered an eight foot Murphy Ventilator Fan, which he says will be in operation in the early part of next summer.

International Mines.—The pit bottom has been retimbered; the back deeps have been driven, connecting No. 9 landing; laid and worked No. 8 and 9 landings. No. 6 section has been driven seawards to the barrier and stopped; south side drove and laid angle deeps, from pit bottom level to No. 1 landing on incline deep. This was done to cut No. 1 and No. 4 landing from north side engine and do away with the haulage of eight railroad horses there, and bring the coal into the opposite side of the pit bottom. The Lidgerwood engine, which had been used to bring the coal along the level, is now used for this purpose. The bankhead is 2,000 feet from the engine, and a tail rope is used along the level—the rope uncoupling automatically; the trip runs down the deep by gravity. On the surface a new nut screen and elevator have been erected, and another modified Rigg screen put in. Blowers were put in under the boilers, and fire-grates adapted to using fine slack coal. These have given every satisfaction. An air shaft has been sunk, intended for an inlet. Mr. Hudson informs me that another shaft is to be sunk this winter, and a new fan and engine put in operation by the spring.

Reserve Mines.—During last winter the east slope was driven down and a new lift of 600 feet gained, and levels turned off east and west. The west levels were driven three chains, and the east eight; back deeps were also driven and rooms broke off and worked parallel to the level. A new travelling road has been made up the back deep on the east side. The barrier between No. 2, east side level, and No. 6, west side, has been pierced for the purpose of letting off the water from that section, which had been filled for a number of years. This done, it was found that the pump on the east side was not equal to the task, and a new pump has been placed at the bottom of the west slope to dry No. 6. The management say that it is their intention to extract and split pillars in that section next season. Ten pair of miners were employed drawing pillars west of this slope during the working season.

The Emery Mine, which had been idle for a number of years, and full of water, has this year been pumped out and a pump placed below the bottom of the pit, by which the water is pumped up the shaft to the surface. This shaft has been repaired, and slides and cages put in. The coal is raised to bank in half-ton boxes. A bank-frame and engine-house have been erected, and an engine and boiler placed therein; also a branch railroad of 400 yards has been built, connecting with the Reserve road. The levels in the west side of the pit have been driven about 700 feet, and headways driven towards the rise; rooms broke off and worked; these rooms are eighteen feet wide; pillars eighteen feet thick; cross-cuts twelve feet, and sixty feet apart. On the east side, the old levels and rooms have been extended, and a pair of dip-slants is being driven, in order to gain a lift of 600 feet.

Old Bridgeport.—Levels and rooms have been extended on the south side of the pit. No mining has been done during the year north of the furnace headway. The band of the shale, spoken of in last year's report, was found to be quite thin in the levels or low rooms, and consequently it was taken down with the top coal, which made the seam about nine feet thick. However, as the levels advanced it was found again to thicken, and the management thought it more profitable to timber and keep it up than take it down. A section of pillars have been drawn from south of mine headway.

Gardner Mines.—This property has been acquired by Messrs. Burchell Brothers. This property has been closed down since 1879, previous to which it was worked by the Gardner Coal Company. It was thoroughly equipped with the best machinery, some of which is still in excellent condition. Work commenced there in the latter part of the summer, getting everything in order to be ready for shipping at the opening of navigation next spring. Engine houses and miners' cottages are being repaired. A substantial pulley frame of some sixty feet high has been erected. The old boilers have been replaced by new ones. The water is being pumped from the mine by two double-acting sinking pumps, one a Knowles and the other a Dean. In a few more days the pit will be dry. I am informed that the seam is to be worked on the long wall system, or on the same principle that Gowrie mines seam is, having the rooms thirty feet in width. This may suit well, as the roof is so strong and regular.

Victoria Mines.—Work has been carried on at this mine in its usual steady way during the year. The east dips have been extended, and a lift of 600 feet gained; this lift being free from water is completely dry; levels have been turned off east and west and driven 150 yards. A balance was driven upon the east side and rooms broke off. The levels on No. 2 lift are still being extended, in driving up the balance. Three places are put up instead of two as formerly. This gives a better opportunity of ventilating places, and leaves safe travelling roads on each side of the balance. There are only nine rooms working on the west side, and I am informed that the men are to be removed to the east side by the latter part of January, where the seam dips less. A new Knowles pump has been put in place of the Blake pump mentioned in last year's report. The coal that was supposed to be lost by the falling in of rooms on the west side of the fault has been regained by driving rooms from the east, coming west through the fault. The management say that it is their intention, this winter, to place a double engine in the fan-house, and a new fan of larger dimensions than the one already there.

Sydney Mines.—I am glad to state that a great improvement has been made in this pit during the year for the safety of men's lives. New travelling ways have been made on the south side, a distance of 1700 yards. On engine and incline planes, where the roadway was found narrow, additional manholes have been driven between the ones there already, according to law. On the north side bankhead landing, where the road was narrow, the place has been made wider for three hundred feet, so that there is now ample room to pass the standing or moving trips. No. 3, or pump deep, has been working since the 27th of May last. This is one of the submerged districts. The deeps have been extended 300 yards in solid coal, and rooms broke off right and left and worked. Electric signals have been placed from them to the engine house, at pit bottom, a distance of 1200 yards. A double line of wire enables signals to be given from any point of the road. Shinner's level district has been stopped for the present. The new angle deeps have not yet gone through the stone trouble. On surface three multitubular boilers have been put in place of as many of the old egg-end boilers.

At the mines of the Eastern Development Co. the following official report of the operations during the year has been issued. The No. 2 shaft was sunk to the 250 feet level, and a cross cut was driven 134 feet to the north cutting the main, or B. vein, which was found to be 32 feet wide, and to yield a considerable proportion of smelting ore assaying from 10 p.c. to 20 p. c. copper, with a little silver and gold. On the new vein lying south of the present workings a shaft has been sunk 50 feet in paying ore, and on the surface it has been traced 1,000 feet. No. 1 shaft was unwatered and repaired, and the drill plant prepared so that a drift would be run into vein B, lying a short distance to the south. The additional drills and compressors alluded to in a previous report have been added to the plant, giving it a strength of ten drills, with two in reserve; and some 3,000 feet of piping has been laid to connect shafts 1 and 3 with the plant at shaft No. 2. On the Argyle area the westward extension of the veins has been further tested, and a point has been selected for a new shaft. About 1,000 tons of ore were extracted and banked.

The quarries of the Bras d'Or Marble Co., at Marble Mountain have been equipped with an excellent plant, including Wardwell Channeller, Gadder, portable engine and boiler, derricks, etc., and work this year will be actively prosecuted. As is well known, the marble deposit is extensive and of the finest quality, some of the white being pronounced by experts equal to the best Italian for statuary, while the colored and mottled varieties are very beautiful and in demand by the trade.

Dr. Edward D. Peters, jr., the eminent copper metallurgist, has gone to the Coxheath copper mines under contract from the Eastern Development Co., limited, to complete plans and specifications for a full plant to hoist, concentrate, calcine and smelt into matte a daily output of 200 tons of ore. Latest advices from the mine state No. 2 shaft down 258 feet, with vein B still holding 22 feet in width. No. 3 shaft down 50 feet and timbered. The company has bonded an additional two square miles of mining rights covering the strike of the large vein in No. 3 shaft and is putting on a surface prospecting force of 100 men to trace that vein on the new areas.

Quebec.

Lievres River.

The General Phosphate Corporation made their first shipment of the season this week, 600 tons of high grade to Hamburg. An important discovery of a bedded deposit of phosphate has been made on the river side of Ross Mountain, and is now being worked with good results. Some 150 men are now at work on the various properties. The plant is not yet completed, but further additions will before long be made; among others an air compressor will be put in.

The boiler-house at Little Rapids was destroyed by fire last week. The new shaft is opening out well, some 3 men taking out from 6 to 10 tons phosphate per week.

The development work on the asbestos property situate on lots 15 and 16 in the 5th range of Portland West, owned by Mr. W. A. Allan, is proceeding satisfactorily. Some promising veins of fine silky fibre are being uncovered.

Eastern Townships.

The Eustis Mining Company, of Capelton, is not at present operating its smelting plant, but is confining itself exclusively to the shipment of ores of various grades and suited for various purposes. The smelting plant at the mine is maintained more for the purpose of taking care of any surplus ores that may not be saleable; but owing to the high price of brimstone, and the consequent quick demand for pyrites that have ruled of late, all the ore mined has been fully sold up, and it is therefore probable that the smelting works will not be operated this year. The ores that are being mined are substantially the same as in former years. They are chiefly low-grade iron pyrites carrying more or less copper and silver, and ores occasionally running high in both. It is a class of ore that requires the utmost economy in its working and treatment, and can ill bear any tax such as the 3 per cent. royalty.

The next monthly meeting of the Asbestos Club will be held at Thetford, on the 28th instant, when Mr. H. J. Williams, superintendent of the Beaver Asbestos Company, will read a paper on the Electric Drill.

Templeton District.

The MacGregor Lake Phosphate Company have struck a fine deposit in their main pit, at a depth of 25 or 30 feet. The phosphate is a rich pale green color. About 25 men and boys are steadily employed.

Messrs. Lomer and Perkins have opened up lot 18 in the 8th range, recently worked by Messrs. Lomer and Higginson, and are stripping some nice shows.

Rev. Curé Forget, of Perkins Mills, has some 16 men opening up his asbestos property near the Goldering mine.

The Netherlands Company are now working on some fine deposits recently struck, and anticipate a good season's output.

The Phosphate Corporation shipped 300 tons by barge through the Blanche river to Montreal on Saturday last from the Murphy mine.

Mr. Thomas Fee is pumping out the old Swamp pit, Jackson Rae mine, and commences working steam drill and hoist this week.

Mr. Koenig, of the Templeton Asbestos Co., is putting in improved iron dump cars at the Ferrans asbestos mine, and is pushing work rapidly.

At the old Blackburn mine great difficulty is experienced in getting pit men and cobbers. Sixteen teams are hauling steadily to the Blanche dump. Shipments by barge commenced about two weeks ago. In about three weeks the water will be too low to barge out of the Blanche, when delivery will be made by the Ottawa river.

The McRae mine, on 5th range, turned out 120 tons last week. Their big show is now 27 feet wide with a 9 foot face, and apparently solid on the bottom. The Edison electric drill and hoist will be shipped from New York this week. Messrs. McRae & Co. intend commencing the improvements at High Falls early in June and expect to have the power ready by the end of that month.

Messrs. McLaurin & Co., East Templeton, and McRae & Co., Ottawa, have, it is understood, purchased the telephone line owned by C. Lionais & Co., and purpose extending the service immediately. This line runs from East Templeton Village to Perkins' Mills, and from thence to the Wallingford property, a distance of some sixteen miles. The new owners will build it a further distance of four miles, giving all the mines in the district this connection.

The ocean freight on phosphate from Montreal to Liverpool and London by regular lines is 7/6 per ton in full. Tramp steamers a shade less.

Great difficulty is being experienced at the mines in the back parts of Templeton in procuring men. The wages now offering for ordinary pitmen are $20 and board; foremen, $25 to $28 and board; boys $8 to $10 and board.

McRae & Co. have commenced opening their phosphate property on lots 5 and 6, in the 2nd range of Masham. Seven men are employed stripping. The ore will be shipped over the Gatineau Valley Railway from the Peche village.

Owing to the high price of oats, teamsters are getting from $3.00 to $3.75 per day, or $2.50 per ton hauling from the Blackburn mine to the river front; from the Mackintosh mine $2.00 per ton.

Dynamite (40% grade), is now being offered delivered at the mines at $16.00 per 100 lbs. in quantities. The Hamilton Powder Co. intend erecting a magazine at Jerry Ferrand's, under the agency of Messrs. J. M. McLaurin and Co., of East Templeton. There are now three companies offering.

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Ontario.

Sudbury District.

Geo. Herbert Harrison of Stourbridge, Eng., one of the members of the Iron and Steel Institute, who visited Canada in the fall, is making an extended tour of the Sudbury district for Birmingham and London people. He is after nickel.

A. C. Campbell, of Toronto, formerly the *Globe* representative in the Dominion House, is spending a few weeks in Sudbury.

Mr. R. J. Tough, the well-known owner of mineral lands is about to leave for British Columbia. He will seek the Kootenai district by a route which will take him through some of the great mining regions of the American west and south-west. Should he find conditions to his liking in Kootenai he will make that district his headquarters.

Mr. Emil Michaud, of Paris, France, collaborateur with the celebrated Garnier in some important inventions relating to nickel, is at present at Copper Cliff carrying on experiments with the Sperrylite or platinum ore which is found at the Vermillion mine. There are problems in the treatment of this new mineral still unsolved, but with further experiments it is hoped that a process will be discovered which will yield rich results.

This week the Dominion Mineral Co. paid off about twenty-five men. These were wood-choppers and prospectors. The season for the former is at an end, and the company has given up prospecting for the present. There are now employed at the Blezard mine three hundred men. A consignment of five hundred tons of matte has just been made to Liverpool, and monthly consignments are made to the United States.

Mr. John Ferguson, manager of the Dominion Mineral Co., has been appointed vice-president, and will remove from the Blezard mine when his successor is appointed. As vice-president he will be general oversecr of the work of the company. Negotiations are in progress with several parties to fill the position of manager including one from the Calumet and Hecla. On leaving Blezard mine Mr. Ferguson will make his headquarters in North Bay, where he has considerable interests.

A fact which has never before been made public, but which goes to show the tremendous value of the nickel finds made in this region is, that two-thirds of the ore turned out at the Worthington mine is packed and sent direct to the refinery. It is so rich that it cannot usefully be treated in the ordinary smelters. The copper and nickel mix but little in the ore, so that it is possible to select large quantities to be handled by the refineries. Thirty-five mcn are now employed at the Worthington mine.

Those who contended that the new mining law will kill off prospecting in this district and confine activity to lands already patented, have the mournful satisfaction of knowing that they were right. At this time last year there were a large number of men in the bush looking for new locations. To-day, so far as anybody in this region can learn, there is not a man thus engaged. Many well known prospectors are at home or engaged in connection with claims already secured. Some have already gone to British Columbia or the United States.

Among the recent visitors to Sudbury is Prof. J. C. Jackson, of Chicago, mineralogist and chemist. Prof. Jackson, according to the Duluth *News* of May 3rd, has just returned from a trip to Grand Marais, Minn., on the north shore. He went there in company with Henry Darlington, of Armour & Co., and other millionaires to inspect a copper mine owned by the syndicate. Prof. Jackson went out on the Soo branch to look after some property of the Chicago Nickel Ore Co. On Thursday Prof. Jackson went to examine property owned by Mr. D. O'Connor in the interest of Chicago capitalists who have bonded the lot. He goes thence direct to Chicago.

Mr. T. E. Johnson, formerly of Parry Sound, now of San Jose, Cal., arrived in Sudbury on Tuesday, accompanied by a gentleman from Chicago. Mr. Johnson has made the trip from California specially to look after some nickel property in Denison, which he owns in conjunction with Mr. Henry Lowndes, of Messrs. Flett, Lowndes & Co., of Toronto. Negotiations are in progress with an English syndicate for the sale of the property and development work will be at once begun. The gentlemen who are inquiring after the property are already engaged in mining, and if they purchase they will undoubtedly begin work upon a large scale. Mr. Peter McGregor will be in charge of the development work.

The new analyst at the Copper Cliff mine, succeeding Mr. Sperry, is Mr. David H. Browne, formerly with Messrs. Andrews & Hitchcock, of Youngstown, O.

Port Arthur District.

A report is current that the Crown Point silver mine has been sold to New York people for a sum of $600,000.

Manitoba and North-West Territories.

The output from the mines of the Alberta Railway and Coal Company is now over 1,000 tons per day, about 400 tons of which is consumed in Canada, the balance going to the various business centres in Montana. The company has been engaged in sinking shafts for some time, and it is anticipated, will have an output of 2,000 tons per day before very long, if transportation facilities will admit. There will be no difficulty as regards a market.

No mining has been done at Anthracite for a considerable time. It is understood, however, that the company to which these mines belong has been reorganized with fresh capital, and will recommence operations both here and at some of its Canmore properties.

The Canada North-West Coal and Lumber Syndicate is opening up the Brinkerhoff claim at Canmore. The output from this mine has been about 80 tons per day, but a tunnel is being constructed which intersects four seams of coal, enabling them all to be worked, and materially increasing the output. These seams are of various qualities, so that a variety of requirements can be met. The company intend, it is stated, to open coking ovens, this coal being valuable for the production of coke and gas. Their mines at Cochrane are not now being worked.

A large number of claims for petroleum have been staked out in Townships 1 and 2, Ranges 29 and 30, west 4th Meridian, but nothing has been done in the way of development; and this is not likely to occur unless some combination of interests should be made, as the averagc claim holder has not sufficient capital to undertake the necessary explorations,

British Columbia.

Kootenai District.

A careful estimate of the men likely to be employed this year in the mines in the Toad Mountain district, says the *Miner*, places the number at 300. Within a month men will be steadily employed on the Silver King, Dandy, Iroquois, Grizzly Bear, Jim Crow, Poorman, Whitewater and Wild Cat, to say nothing of the men at work on the placers on Hall creek and on the gold prospects on the south side of the river and the copper and galena prospects on the north side. Last year the number so employed was less than 75.

The Revelstoke Smelting Syndicate are prepared to purchase all ores of Trail Creek camp, and in fact all ores mined in the district, and Dr. Campbell and Mr. Boyle were at the mines last week to make arrangements with the mine owners for the output of their properties.

Work is to be commenced at once on the road between Nelson and the mines on Toad Mountain.

In sinking on the Democrat, a claim in the Iroquois group, a vein carrying peacock copper ore was struck at a depth of twenty-five feet.

The first dust from the Hall Creek placers was brought to Nelson in the beginning of this month, and is good looking coarse gold. Owing to the snow, no sluicing has been done on any of the claims, but good headway has been made in drain ditches and other preparatory work. It is claimed that these diggings are good for an ounce a day per man.

The Highland, Daniro, and G. W. R., three claims in Hot Springs district, have been surveyed for Crown grants. In surveying the Highland, a three-foot ledge of carbonate and galena ore was discovered. The new discovery makes the Highland a valuable property, and its owners, J. C. Rykert & Co., are greatly elated.

Reports from Goat River district are very encouraging. Several new discoveries have been made lately, chief among which is one by C. C. Sproule and George Long, at a point above "Jap" King's Alice. The owners of the Alice have done considerable work this spring in making trails and roads. Mr. King said that he had been prospecting for a good many years, and for the first time he has got hold of a property (meaning the Alice) that he is not afraid to work or let anyone else work.

At the Silver King the tunnel is in 40 feet beyond the old cross cut and is still in ore. There are now five shifts at work, and preparations are being made to sink a shaft near the intersection of the cross cut and the tunnel. It is rumored that $2,000,000 has been offered for the property, and the proposal is now under consideration by the Hall and Atkins Estates interests.

The terms of the Dandy sale are now on record at the mining recorder's office in Nelson. The price paid for the Kelley and Fox interests—seven-eighths of the whole —was $172,500. Of this amount $50,000 was paid in cash, the deferred payments to be made as follows :$5,000 on June 10th, 1891 ; $5,000 before October 7th, 1891 ; $112,500 by April 7th 1892. The Cook interest—one eighth—was purchased for $4,000 ; $500 cash, $1,000 by June 1st, and $2,500 by August 1st. The price paid for the Dandy is therefore $176,500. A. M. Esler, who purchased the property, will be on the ground as soon as he can get in machinery, and expects to have development work commenced in earnest by July 1st.

A half interest in the Ollie, a claim which joins the Dandy on the west, has been sold to A. H. Kelly ; the consideration in the bill of sale being $10,000.

Owing to a scarcity of supplies little is being done in a mining way in Hot Springs district, and little is likely to be done until the snow goes off so as to make it practicable to pack supplies to the mines.

An eighth interest in the Boulder hydraulic claim on Forty-nine Creek, together with interest in several undeveloped prospects, was sold this week for $900—$700 of the purchase money being cash. N. Riopel and J. P. Lamotte were the purchasers and Edward Barker the seller.

Vancouver Island.

The hydraulic mining machinery which will be used on the South Forks of the Quesnelle River, has partly arrived. It is manufactured by the Joshua Hendy Machine Works, of San Francisco.

The following shipments of coal are reported for April:—

New Vancouver Coal Co	35,181	tons.
Wellington Colliery	16,521	"
East Wellington	4,515	"
Union Colliery	8,700	"

The coal-cutter at the Union mines is giving great satisfaction, so much so indeed that the management contemplate installing additional machines.

CANADIAN COMPANIES.

The Lyndhurst Lead Mining Company of Ontario —Application for incorporation under Ontario laws will be made by the above company for the purpose of exploring for, mining, smelting and manufacturing lead, silver, copper, nickel and other ores and metals, in the county of Leeds. Head office, Lyndhurst, Ont. Capital stock, $100,000 in 100,000 shares of $1. Applicants, H. L. Barker, Lyndhurst; J. B. Perkins, A. W. Petrikin, A. A. Clough and L. A. Clough, Denver, Col., the first four of whom are to be the first directors.

The Leeds Copper Company (Ltd).—This company has been formed to acquire the Leeds copper mines, originally the Harvey Hill mines, at West Broughton, Que. It is virtually the reconstruction of the Excelsior Copper Company on a new basis. The capital stock is £450,000 in £1 shares, which are credited with 18s. 6d., the remaining 1s. 6d. being assessed. The old shareholders have taken up 250,000 shares in London, and of the 110,000 held in Canada 60,000 have been subscribed for. The new board of directors is as follows: J. Armitage J. P., Bradford, chairman; R. Brown, Leeds; R. P. Gould, London ; Geo. Bathison, London. No Canadian directors have yet been appointed. The head office is at 19 Broad Street Avenue, London, E.C.

Western Consolidated Mining Company—This company has been incorporated under the laws of the State of Washington, and will be registered for work in Canada, principally in British Columbia. Its objects are the purchase and ownership of mines, mining claims and real estate in Canada and the United States, to acquire water rights, erect plant, reduction works, etc., to mine and dispose of minerals, and generally to carry on a mining and milling business in all its branches, with other customary powers. Head office, Spokane, Washington. Capital stock, $1,000,000 in 1,000,000 shares of $1 each, one-half or $500,000 of which is set aside for development and purchase of other properties. Officers, C. M. Parker, J. B. Sargent, W. H. Lynch, N. A. Parent; secretary, A. J. Lynch, Spokane, Washington.

The Bonanza Nickel Mining Company of Sudbury (Ltd).—Letters patent have been granted by the Ontario Legislature incorporating the above company for the purpose of acquiring, selling, and disposing of mining lands in the province, carrying on mining operations, etc. Head office, Toronto. Capital stock, $150,000 in 6,000 shares of $25 each. Those incorporated are: O. J. Wells, G. B. Foster, T. W. H. Leavitt, W. B. Stephens, Toronto, and J. J. Carberry, Fond-du-lac, Wis.

Anglo-Canadian Asbestos Company.—The *Financial News*, under date of the 18th ult., has the following: "It is pleasant to be able to note that there is one Canadian asbestos company other than Bell's which is doing well. There was a meeting of the Anglo-Canadian Asbestos Company—which our readers may remember was reconstructed some 18 months ago—on Thursday, when the directors were able to recommend a dividend at the rate of 20 per cent. This very satisfactory result is due to careful and efficient management of a valuable property, and there is every reason to hope and believe that i prices remain at anything like their present standard th earnings of the company for the current year will be eve more substantial than for the year just closed."

Anglo-Canadian Phosphate Company (Ltd.)—A the annual meeting of this company, held on the 21st ult. the directors' report and balance sheet were adopted an the retiring director was re-elected. Captain R. C Adams, the managing-director, was present and explaine the difficulties that had been experienced during the year It was decided to continue working on the same lines a last year.

The Alberta Railway and Coal Company.—A Special General Meeting of this company will be held at 37 Old Jewry, London, on Monday, June 15th, at 3 p.m., for the purpose of electing a director.

The Anglo-Canadian Electro-Storage and Supply Company.—This company is applying for incorporation under Dominion laws for the purpose of manufacturing, selling and leasing secondary batteries and all kinds of electric supplies and appliances, also to supply light, heat and power, with authority to construct, operate and maintain systems for transporting materials and passengers by electric power.

Victoria Gypsum Mining and Manufacturing Company (Ltd).—This company will apply at the next session of the Nova Scotian Legislature, for an act to amend its act of incorporation, viz: to fix a mode of procedure for taking and appraising land, where the same may be required, for the purposes of said company and defining certain properties and works as to exemption from taxation. Solicitor for applicants, F. G. Forbes, 37 Sackville street, Halifax, N.S.

Malaspina Red Granite Quarry Company.—A meeting of the shareholders of this company was held on the 28th ult., at Nanaimo, B.C. This quarry was located last year by Major Downie, from whom the company acquired it, the Major retaining ten shares in the concern. The following officers were elected: Mr. J. H. Pleace, president; Mr. W. H. Morton, secretary; Mr. J. Ganner, treasurer, and Messrs. E. Pinbury, L. Manson and Major Downie, trustees. The company was formed with a capital of $10,000, being 20 shares at $500 each.

Eastern Development Company (Limited)—At the annual meeting of the Eastern Development Co. (Ltd.) held at Boston, Mass., May 4th, the following Management was elected: Captain Isaac P. Gragg, president and general manager; Col. Albert A. Pope, Vice-President; M. F. Dickinson, jr., Auditor; Hon. W. E. Barrett, Marcus Beebe, with Thos. Wair, Secretary and Treasurer. 101,000 shares out of 127,000 outstanding, were represented. Treasurer's report showed $31,000 cash on hand, bonded indebtedness, $349,000. Directors have authorized an issue of $1,000,000, 7% twenty years gold bonds; American Loan & Trust Co., of Boston, Mass., Trustees. $350,000 will be issued in exchange for those of the present issue outstanding. An additional $350,000 offered at par, with 50 shares of stock, is a bonus with which to erect works to mine and treat 200 tons of ore per day. Estimated cost of works, $300,000. Balance of $300,000 of Bonds to be reserved subject to action of Directors. Messrs. Irving A. Evans & Co., brokers, at Boston, have undertaken to place the additional bonds. A contract has been made with Dr. E. D. Peters, jr., M. E., to complete plans for full plant, and he left for Coxheath mines on the 7th inst. Col. Brownell Granger, mining captain, reports No. 2 shaft down 270 feet, the main vein on the 250 feet level still holding over 20 feet wide, both breasts in fine ore; Shaft No. 3 in new vein down 60 feet and timbered, new horse chain and shaft buildings completed. This vein promises to be a large one; the 11 x 7 shaft being in ore on all sides, it will be cross-cut at 100 feet depth to ascertain full width and dip.

General Mining Association of London, Eng., (Ltd.)—The ordinary half-yearly general meeting of the proprietors of the General Mining Association (Limited), was held at the offices of the Association, Bloomfield House, London Wall, E.C., on the 24th ult. Mr. James Duke Hill presided, and in moving the adoption of the report and accounts, said the chief feature in the report was a good year at their principal mine of Sydney, in Cape Breton. But unhappily there had been a decidedly bad year at their other mine, Victoria, and the unfortunate results of the operations there had undoubtedly caused a great disappointment to the directors, and had no doubt prevented them from paying an increased dividend. The cause of this was a totally unforeseen one, for no one could anticipate the shortness of labor which occurred, and which was the reason of the diminished output at this mine. He could congratulate the shareholders on the satisfactory results of the operations at Sydney. They had had an increased demand for their coal, and the reduction in the freight had enabled them to have their coal conveyed at a considerably reduced cost. They had also had a lengthened shipping season, and had they been equally as fortunate at Victoria, there could have been no doubt but what the operations would have been in every way satisfactory. Although he did not care to prophesy, still the prospects for the present year were most favourable. They were looking forward to a very considerable increase of coal both at Sydney, and more particularly at Victoria. To grapple with the difficulty of shortness of labour they had made up their minds to send out colliers from Scotland, and 35 men were now on their way. With the aid of these, Mr. Brown, the manager, hoped to materially increase the result of the operations at Victoria during the year. They were aiming at doubling their output at Victoria, for a large output was the life and soul of a colliery. In order to effect this a large number of men was necessary, and to attract labor the Association was doing everything in their power. Sales of coal from the Sydney mines were 156,042 tons, as against 131,751 tons in 1889, and from the colliery worked by the Low Point, Barrasois and Lingan Company 78,033 tons, as against 91,835 tons in 1889. The profits on the year's trading were £8,624, and with £1,566 brought forward, the available balance is £10,191, out of which the directors propose a dividend of 6s. per share, leaving £1.950 to be carried forward. Mr. W. S. Cunard seconded the motion for the adoption of the report and accounts, and this was agreed to unanimously. The retiring directors and auditors were afterwards re-appointed.

Tilt Cove Copper Co. (Ltd.). The annual meeting of this Company was held in London on the 30th ult. The accounts showed the value of the ores raised in the year ended March 31st to have been £21,764, and after including debenture interest, the debit balance brought forward was raised from £15,575 to £25,991. Smelting furnaces had been erected immediately upon the Cape Copper Company taking over the work, and three were put in operation late in the year, but were soon closed owing to the weather. The experience of the past has shown that it is necessary to smelt their own ore and to mine it economically. These conditions are now being fulfilled. The chairman said that there was a great deal of ore in sight at the East mine, and he was certain that when they had driven Boden's level, situated about 350 feet below the upper workings, and which is progressing at the rate of over 54 feet a month, they would come across a good vein of ore, as the quality improved with the depth. At the West mine he had no doubt but that they would strike some rich pockets of ore, such as were met with in former workings. They had very large deposits of low grade ore also, previously untouched, which would be valuable for flux for smelting purposes, as would also the refuse dumps, which contained a fair percentage of copper. One of the directors stated that the company now saw its way to bringing home the regulus at 7s. 6d. per unit, which they would be able to sell at 9s. 9d. per unit. The combination with the Cape Copper Company, which has leased the mine, seems likely to prove an excellent one. The report and accounts were adopted and the meeting adjourned.

The Canada Chemical Manufacturing Company (Ltd).—Application will be made by the above company for incorporation under Dominion laws. The purposes of the said company are to be the manufacture, purchase, and sale of chemicals and dye stuffs; mining, prospecting, developing, working, buying and selling of minerals, mineral ores and mineral lands; reducing, crushing and smelting iron or copper pyrites and other minerals and mineral ores, selling and disposing of the products of such mines, minerals, mineral ores and manufactures, either in crude or other form, throughout the Dominion of Canada and elsewhere, with other customary powers. Head Office, London, Ont. Capital stock $80,000 in 1,600 shares of $50 each. Applicants, W. Bowman, T. H. Smallman, Ellen Smallman, J. H. Bowman, J. B. Smallman, all of London, Ont., all of whom are to be the first directors.

The Tulameen Improvement and Hydraulic Company (Ltd).—The above company is applying for incorporation, under the British Columbia Act, for the purpose of constructing hydraulic or other processes of mining: to own and construct ditches, flumes or other systems of water-ways; to purchase, own, operate and sell mines, minerals, water and water-ways; to build, operate, and own mills, machines or other processes for the reduction of ores, and to sell the same, with other customary powers. Head Office, New Westminster, B.C. Capital stock $60,000 in 60,000 shares of $1 each. Applicants, A. Ewen, J. C. Armstrong, J. A. Laidlaw, New Westminster; J. Wilson, Revelstoke, and T. R. McInnes, Victoria; of whom J. Wilson, J. C. Armstrong and A. Ewen are to be the first directors. The time of existence of the company is to be fifty years.

The Port Haney Brick, Tile and Terra Cotta Company (Ltd).—Application will be made by this company for incorporation, under the British Columbia Act, for the purpose of purchasing and carrying on the brickyards owned by Messrs. Beckett & Co., and T. F. Sinclair & Co., respectively, situate at Port Haney, B.C.; to acquire and work any other brick yards; to purchase, charter, and use steamboats, lighters, scows, etc., and to erect buildings, put up electric plant, etc., with all other customary powers. Head office, New Westminster, B.C. Capital stock, $50,000, in 500 shares of $100 each. Applicants, W. Wolfenden, A. G. Gamble, C. E. Woods, New Westminster, B.C.; H. R. Beckett, Port Haney, B.C.; and T. F. Sinclair, Victoria, B.C.; all of whom are to be the first directors.

Prevost Island Company (Ltd).—Application will be made for incorporation, under the laws of British Columbia, by the above company, in order to purchase and lease lands on Prevost Island, B.C., and other adjacent islands; generally to work, manage and dispose of the same, and the mineral rights, with other powers. Head office, Victoria, B.C. Capital stock $15,000, in 30 shares of $500 each. Applicants, M. W. Tyrwhitt Drake, J. Peters, H. E. Croasdaile, H. Dumbleton, and H. Abbott, all of Victoria, B.C., all of whom are to be the first directors.

E. Broad & Sons (Ltd).—Notice is given in the *Canada Gazette* that application will be made for the incorporation of the above firm. The object of the company is to manufacture edge tools and tools of any kind made of iron or steel or of both iron and steel, and to manufacture handles of wood and any other goods deemed advisable. Head Office, St. Stephen, N.B. Capital stock $40,000 in 400 shares of $100 each. Applicants, W. Broad, St. Stephen, N.B.; J. L. Gilmour, E. Arnoldi, W. B. Gilmour, Montreal; H. S. Burritt, Ottawa, all of whom are to be the first directors.

The Albion Mines Savings Bank.—Notice is given that application will be made at the next session of the Parliament of Canada, to further continue in force the Act incorporating "The Albion Mines Savings Bank" as amended and extended by Acts of the Parliament of Canada passed in the thirty-seventh and forty-eighth years of Her Majesty's reign, and respectively intituled "An Act respecting the Albion Mines Savings Bank," and "An Act to continue an Act respecting the Albion Mines Savings Bank."

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Latest Stock Quotations of Canadian Companies in England.

	Price.	
Excelsior Copper, Limited, £410,738 fully-paid shares of £1	—	
Nicola, Limited, £35,000 fully-paid shares of £1	—	
Shuniah Weachu, Limited, £99,888 fully-paid shares of £1	—	
Silver Wolverine, Limited, £68,465 fully-paid shares of £1	—	
Tilt Cove Copper, Limited, £160,000 fully-paid shares of £2	—	
Ditto, £80,000 5½ per cent. debentures	—	
General Mining, Limited, £219,752 fully-paid shares of £8	3¼	3¾
Low Point, Barrasois and Lingan, £509,100 fully-paid shares of £100	—	
New Vancouver Coal Mining and Land, Limited, £185,000 fully-paid shares of £1	¾	1
North-Western Coal and Navigation, Limited, £160,500 6 per cent. debenture coupons, June 30 and December 31; principal 1904	—	
Ditto, £149,500 fully-paid ordinary shares of £10	—	
Ditto, £900 fully-paid deferred shares of £100	—	
Sydney and Louisburg Coal and Railway, Limited, £50,000 cumulative 10 per cent. first preference shares of £10, £6 paid	7½	8½
Ditto, £14,560 fully-paid non-cumulative 6 per cent. second preference of £10	3	5
Ditto, £250,000 fully-paid ordinary shares of £10	¼	¾
Anglo-Canadian Asbestos, Limited, £11,500 fully-paid shares of £1	2⅞	3⅛
Anglo-Canadian Phosphate, Limited, £46,510 fully-paid preference shares of £10	—	
Ditto, £25,000 fully-paid deferred shares of £10	—	
Bell's Asbestos, Limited. £140,000 fully-paid shares of £5	10	10¼
Ditto, £68,400 debentures, 5 per cent.; interest January 1 and July 1	—	
Canadian Phosphate, Limited, £100,000 fully-paid shares of £1	—	
General Phosphate, Limited, 5 per cent. ordinary shares of £10, £2 paid	—	
Ditto, £5,000 fully-paid founders' shares of £10	—	
Western of Canada Oil, Limited, £200,000 fully-paid shares of £100	—	
Ditto, £99,850 fully-paid shares of £50	—	
Western of Canada Oil, Limited, £199,700 12 per cent. debentures of £100	—	
White's Asbestos, Limited, £20,000 fully-paid shares of £1	—	
Ditto, £15,000 shares of £1, with 15s. paid	—	

Excelsior Copper.—Registered September 26, 1888. Accounts to December 31 submitted in April. No dividend yet. Liquidation and reconstruction have been decided upon.

Nicola.—Accounts to December 30 submitted in November. No dividend yet.

Shuniah Weachu.—Accounts to November 20 submitted in February. No dividend yet. Shares for £12,870 held by the Company.

Silver Wolverine.—Registered October 19, 1888. No report of meeting received yet.

Tilt Cove.—In March, 1890, the properties were leased for 99 years to the Cape Copper Company, Limited, at a rent of £4,400. The Cape Copper Company advance £15,000 at 5 per cent. interest, and when this is repaid out of profits; surplus profits are to be divided equally between the Cape Copper Company and the Tilt Cove Company. The lease may be determined by the Cape Copper Company at any time on twelve months' notice. Accounts annually to March 31 submitted in November.

General Mining.—Accounts to December 31 submitted in April, but an interim meeting is held in November. Dividend for 1884, 5 per cent.; for 1885 and 1886, 3⅛ each year; for 1887, £4 13s. 9d. per cent., and for 1888 and 1889, 3¾. Reserve fund, £29,850.

Low Point.—Accounts to December 31. For 1887, 1888, and 1889, 5 per cent was paid each year on the ordinary shares publicly held; for 1888 the ordinary shares issued to the vendors got 3½ per cent., and for 1889, 2½.

New Vancouver Coal.—Reconstructed in 1889. Accounts to June 30 and December 31 submitted in November and May. For the two half-years to June, 1889, 5 per cent. per annum was paid, and for the two half-years to June, 1890, 4. Debentures, £60,000.

North-Western Coal.—The deferred shares receive no dividend until 15 per cent. per annum (cumulative) has been paid on the ordinary. Accounts to June 30. Dividend for 1887-8 and 1888-9, 5 per cent. per annum.

Sydney and Louisburg Coal.—Accounts to December 31 submitted about May. In respect of 1889 15 per cent. was paid on the first preference, leaving arrears of 50 per cent.

Anglo-Canadian Asbestos.—Reconstructed in 1889. At general meeting held on 16th April, a dividend at the rate of 20% per annum was declared.

Anglo-Canadian Phosphate.—The preference shares rank first for 7 per cent., and after a like rate has been paid on the deferred shares, both classes rank equally. Accounts to November 30, submitted in May. No dividend yet on either class. Debit to profit and loss on November 30, 1889, £4,784. One of the mines has recently been sold and another leased.

Bell's Asbestos.—Accounts to December 31 submitted in January. Dividends for 1888 and 1889, 22½ per cent. each year. Reserve, £5,000. The debentures are redeemable by 1913, by annual drawings at 115 from a sinking fund, which the directors may increase.

Canadian Phosphate.—Accounts to November 30 submitted in February. Eleven months to November 30, 1888, resulted in a profit of £2,576. which was carried forward. A dividend of 6d. per share is to be paid November 1, 1891.

White's Asbestos.—Registered April 9, 1889. Accounts submitted on December 31. Liquidation has been decided on.

◆

The Construction of Details for a Modern Lixiviation-Plant.*

By C. A. Stetefeldt, San Francisco.

A modern lixiviation-plant for the treatment of silver ores with hyposulphite solutions differs so materially from its ancestors, that a critical description of the improvements recently carried out and proposed, will not be without interest to metallurgists. While the general arrangement of such a plant depends upon local circumstances, its details of construction are more or less constant and can be described from a general standpoint.

The plant consists of wooden tanks in which the ore is treated and solutions are accumulated; apparatus for elevating and transferring solutions, and for creating a vacuum below the filters of ore tanks; filter presses and drying chambers for handling precipitates; apparatus for manufacturing sodium sulphide, etc.

§ 1. WOODEN TANKS.

Construction.—Tanks should be made of clear, well-seasoned lumber. In the United States, Oregon pine is the best material for this purpose. The staves, from 3 to 4 inches thick, according to size of tank, should be ordered cut to sweep of radius, and from 9 to 10 inches longer than the inside depth, but not "gained" for the bottom. The gaining of the staves, 1 inch deep, is done by hand, leaving a chine of 6 inches below the bottom. In all tanks the staves stand perpendicular to the bottoms. The bottom pieces, 3 to 4 inches thick, are cut to a diameter of 2 inches greater than that of the finished tank; they are grooved and joined by a tongue. All joints must be fitted with precision. White lead should never be put between the staves, but may be used in inserting the tongues between bottom pieces. The understructures of substantial timbers, placed on a solid foundation, should be sufficiently high to allow access to the bottom in case of leakage. The bottoms rest on joists, 3 to 4 inches wide and 10 to 12 inches deep, placed about 2 feet 6 inches apart, so that the staves are left entirely free. Hoops are made of round iron, ⅞ to 1⅛ inches diameter, the threaded ends, with hexagonal nuts, passing through forged or cast iron lugs, giving preference to the former. In order to get the full strength of the rods, the threaded ends are taken ¼ inch larger than the diameter of the rod. For tanks of large diameter, each hoop is made in two or three sections; this is necessary to effect a more uniform closing of the stave joints by tightening the nuts in two or three places.

After finishing, the tanks are painted on the outside, staves and bottoms, with three coats of white lead.

Dimensions.—Formerly, the dimensions of lixiviation-tanks were taken quite small: Ore tanks not larger than 12 feet diameter and 3 to 4 feet deep; precipitating tanks, solution sumps and storage tanks of corresponding dimensions. In recent works, however, ore tanks of 16 to 20 feet diameter and 8 to 9 feet depth; precipitating tanks, solution sumps and storage tanks of 12 feet diameter and 8 to 9 feet depth are put up. As can readily be seen, the care and attention required to finish a charge in an ore tank, or to precipitate a solution in a precipitating tank, are independent of the size of the vessel; hence, the great advantages of large sizes.

The capacity of an ore tank for twenty-four hours depends upon the specific gravity of the ore, the quantity of first and second wash-water, and of stock solutions required for treatment, but principally upon the rate of lixiviation. Capacity increases in proportion to diameter, but remains nearly stationary so far as depth is concerned; that is, the same number of ore tanks will be required whether their depth is 9 feet or only 4 or 5 feet, in order to treat a stipulated quantity of ore per day. In fact, should the rate of lixiviation increase with reduced depth, the same number of shallow tanks would put through in twenty-four hours more ore than deep ones. The principal advantage of increased depth consists, therefore, only in reducing the number of charges treated.

Sluicing Tailings.—Where water is abundant, tailings are now removed by sluicing, and great depth of the charge is no disadvantage. Even where water is scarce, and tailings have to be removed by hand, deep tanks should be used. It is only necessary to provide mechanical means for moving above the tanks large buckets into which the tailings are shovelled.

Filters for Ore Tanks.—The false bottoms for the filter and the latter itself, are prepared as follows: Wooden slats, 1¾ inches high and 1 inch wide, and separated 1 inch from each other, are fastened to the bottom. This has, so far, been done with iron screws, bedded in white lead; I would suggest pins of hard wood. The inside of the slats, next to the bottom, is cut out in many places, ¾ inch deep and 3 inches wide, so that a free passage of the solution below the filter is established. Between the ends of the slats and the staves a clear space, 1½ inches wide, is left. A strip of wood 1¾ inches high and one inch wide, previously cut with a saw in many places, and well soaked in water, so that it will bend easily, is now fastened round the slats, leaving an annular space ½ inch wide between the strip and the staves. One thickness of stiff matting, covering the slats and the circular strip, but not the annular space, forms the foundation of the filter cloth proper. The latter, No. 10 canvas duck, is cut to a diameter 6 inches greater than the inside of the tank, so that the ends can be pressed into the annular space described above, and kept in position by forcing down a half inch rope.

Sluice Gates.—A gate for slucing tailings is illustrated in the *Trans.*, vol. xv., p. 359. The discharge opening should be 18 to 20 inches wide and 8 to 9 inches high. The door is covered with a sheet of rubber, and should be suspended by a counter-weight when removed. For very large ore tanks, say 18 to 20 feet diameter, it is desirable to have two sluice gates diametrically opposite to each other. The bottom of the gate should be flush with the filter.

Solution Outlets for the Ore Tanks.—These are made of 2 inch, 6 ply rubber steam hose, which is inserted in the following way: A piece of clear plank, 3 or 4 inches thick, is fastened to the bottom of the ore tank with wood screws, and a hole. having the exact size of the outside diameter of the hose, is bored through the bottom and the plank, at a flat angle of about 30°. Through this hole the hose is forced. All joints are made with thick white lead, the wood screws being also bedded in this material. A pin of hard wood is finally driven through the end of the hose into the wood. If the solution hose is permanently connected with a Montejus (see § 6) for producing a vacuum below the filter, and leaching with water from below the filter, is desirable, a second hose should be inserted in the bottom of the tank and connected with the water pipe. Finally, a third outlet may be provided and connected with a Koerting ejector or a geyser pump (see § 7), if circulation of extra solution is necessary.

Launders for Solutions in front of Ore-Tanks.—These launders, 6 inches wide and 8 inches deep, are made of clear 1½-inch lumber, and painted inside and outside with asphalt varnish. They are placed level, and should be held together with properly constructed braces. Connection with precipitating-tanks is made by 3-inch, six-ply rubber hose, which is inserted in the same way as the hose in the bottom of the ore tanks, but the hole is not bored slanting.

Launders are needed as follows: One for silver bearing wash water, one for waste water, one for solution, one for weak solution. If it is desirable to treat ore at different periods with cold and hot solutions, and to keep these solutions in rotation separately, a filth launder must be added. Launders are either placed a short distance below the ore tanks (from bottom of staves to top of launders, about nine inches), and above the precipitating tanks (about 6 inches from bottom of launders to top of precipitating tank); or 5 to six feet above the top of precipitating tanks, and below the upper floor round ore tanks. The first position is taken, if no artificial means are used, to increase the rate of lixiviation; the second if the rate of lixiviation is increased by a Montejus with vacuum. (See § 6). The high position in the latter case is necessary to give sufficient head to the discharge through the 3-inch hose of the launder, when the solution is suddenly pressed up from the Montejus.

Boxes for Chemicals.—Solutions introduced to the ore tanks are first conducted to a wooden box or barrel, with holes in the sides, standing on top of the charge. This prevents stirring up of the ore by a strong current of solution. These boxes also receive the copper sulphate and sodium hyposulphite for making extra solution in the ore tank.

Tail Races.—If tailings are discharged by sluicing, proper attention should be paid to the construction of tail races. Their inclination depends, of course, on the specific gravity and coarseness of the material; it should never be less than ¾-inch to the foot.

Precipitating Tanks.

Stirrers.—For stirring by hand, an oar of ash, 16 feet long, is used. Mechanical stirrers are, however, far superior to hand-stirring. The best form of a stirrer is a propeller screw of about 2 feet diameter, making 120 revolutions per minute. The screw revolves about 1 foot above the bottom of the tank. Since the lower end of the propeller shaft can not be very well left without a guiding bearing, and at the same time should be protected against the corroding influence of the solution, it is enclosed in a heavy glass tube, held in position by rubber nipples and iron washers. The guiding bearing is made of *lignum vitæ*.

Stirring solutions with air, as described in the catalogues of the Koerting Bros., is very effective. Some trials have recently been made with air stirring at the Marsac mill; but it remains to be seen whether this method decomposes sodium hyposulphite in perceptible quantities or not.

Decanting Pipes.—The decanting of the clear solution, after precipitation, is done by a swinging 2-inch gas pipe, working through a stuffing box. An illustration of this arrangement is found in the paper of Mr. Daggett, *Trans.*, xvi., 446. The pipe is marked there 4 inches, which is too large. When a propeller stirrer is used, the pipe moving up and down cannot pass through the center of the tank, but must be shifted 18 inches away from it.

Outlet for Precipitates.— Precipitates are discharged by a 2-inch asbestos-packed angle cock, inserted close to the bottom of the tank through the staves.

Launders.—In front of the precipitating tanks are launders, leading the decanted solution to the solution sumps, and running decanted wash water or weak solution to waste. If cold and hot solutions are kept in rotation separately, two launders must be placed in front of the silver precipitating tanks, one leading to the sump for cold, the other to that for hot solution. The launders at the back, conveying precipitates to the storage tanks for sulphides, wash water precipitate and lead carbonate, should be inclined, with a fall of about 4 feet in 100 feet. These launders are constructed in the same way as those in front of the ore tanks, but need not be so large.

Storage-Tanks for Precipitates.

These are made about 10 feet in diameter and 3 feet deep. A 2-inch rubber hose forms the outlet for precipitates through the bottom. A 1-inch decanting-pipe for solution is inserted through the staves about 1 foot above the bottom. Both outlets are connected with the press-tank.

Solution-Sumps and Storage-Tanks.

These should be made of the same diameter as the precipitating-tanks, but about 1 foot less in depth. Two of each kind should be provided, especially where solutions are heated, and hot and cold solutions are kept in rotation separately.

§ 2. PRECIPITATING-TANKS FOR WASH-WATER.

If it is desirable to precipitate silver and copper from the water by scrap-iron and sulphuric acid, the process is best conducted in the apparatus described and illustrated in my book, "The Lixiviation of Silver-Ores," page 159.

§ 3. SODIUM SULPHIDE TANKS.

The sodium sulphide mixing tank is made of cast iron, 3 feet diameter and 7 feet deep. Its great depth is necessary because the concentrated lye foams considerably while adding the sulphur. The bottom is covered 1 inch deep with lead, to prevent its wearing out where steam is admitted for heating the lye. The two sodium sulphide storage tanks, receiving the diluted solution, are made of $\frac{3}{16}$-inch boiler iron, about 6 feet in diameter and 5 feet deep. All the tanks are provided with 1½-inch asbestos-packed cocks. It may be desirable to increase the contents of sodium hyposulphite in the solution by rapid oxidation. For this purpose a gas pipe coil, perforated by numerous small holes, is placed on the bottom of the tank and connected with an air compressor. The air is then forced in small bubbles through the solution. Material and size of tanks for Solvay soda solution are not of importance.

§ 4. APPARATUS FOR HEATING THE STOCK SOLUTION.

Apparatus for heating stock solution can be placed either in the solution sumps or in the storage tanks, depending on the most convenient location of the boilers. Coils of lead pipe, through which steam is conducted, are very effective, but unfortunately, not sufficiently durable to warrant their cost. Although lead is not attacked by a pure hyposulphite solution, the stock solution contains sulphates and chlorides, and these may form lead sulphate and chloride, both soluble in hyposulphite salts. Besides, we have to consider that the stock solution is never entirely free from silver and copper.

At the Marsac mill, heavy cast iron pipes one foot in diameter have been substituted for lead coils with satisfactory results regarding durability and cost.

I suggest giving to these heaters the shape of large, round, hollow disks, for a more economical utilisation of steam.

Either heaters should be provided with steam traps, or the escaping condensed water and steam should be conducted to the feed water tank for the boilers.

(To be continued).

◆

Handling Pig Iron.—A method of removing pig iron from the pig-beds, has been designed by Mr. J. L. Boyer, and is intended to dispense with manual labor. The apparatus consists of two grappling devices, of four hooks each, suspended from trolleys running on a traveller which spans all the pig-beds. The grapples are driven by steam pistons, and are worked by a man and a boy. They take up several pigs at once, and can remove the iron as soon as it is cool enough to retain its shape.

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*Trans. Am. Inst. of Mining Engineers.

MACHINERY MECHANICS & INVENTIONS

Suspension Cableways at the Tilly Foster Iron Mines, Tilly Foster, N.Y.

The great rock and ore excavation at Tilly Foster, N.Y., has attracted an immense amount of interest among engineers and contractors. Through the courtesy of the Lidgerwood Manufacturing Company, the prominent hoisting engine manufacturers of New York, Chicago and Boston, we are enabled to present in this issue several interesting sketches, made by them, illustrating this property, and the working of the suspension cableways—a superior system of hoisting and conveying.

Fig. 1 is a general view of the mines looking south-west.

Fig. 2 is a plan showing the location of the cableways and railroad tracks. The plan shows an opening 450 feet long by 300 feet wide on the top; the depth of the pit is about 300 feet.

In Fig. 3 we have a view of a number of workmen filling the skip in the pit. It will be noticed that however rough the floor of the pit the skip may be landed equally well, and the workmen in filling it do not have to lift rock higher than 16 or 18 inches.

Fig. 4 shows a cross section of the mines directly under the incline cableway No. 1.

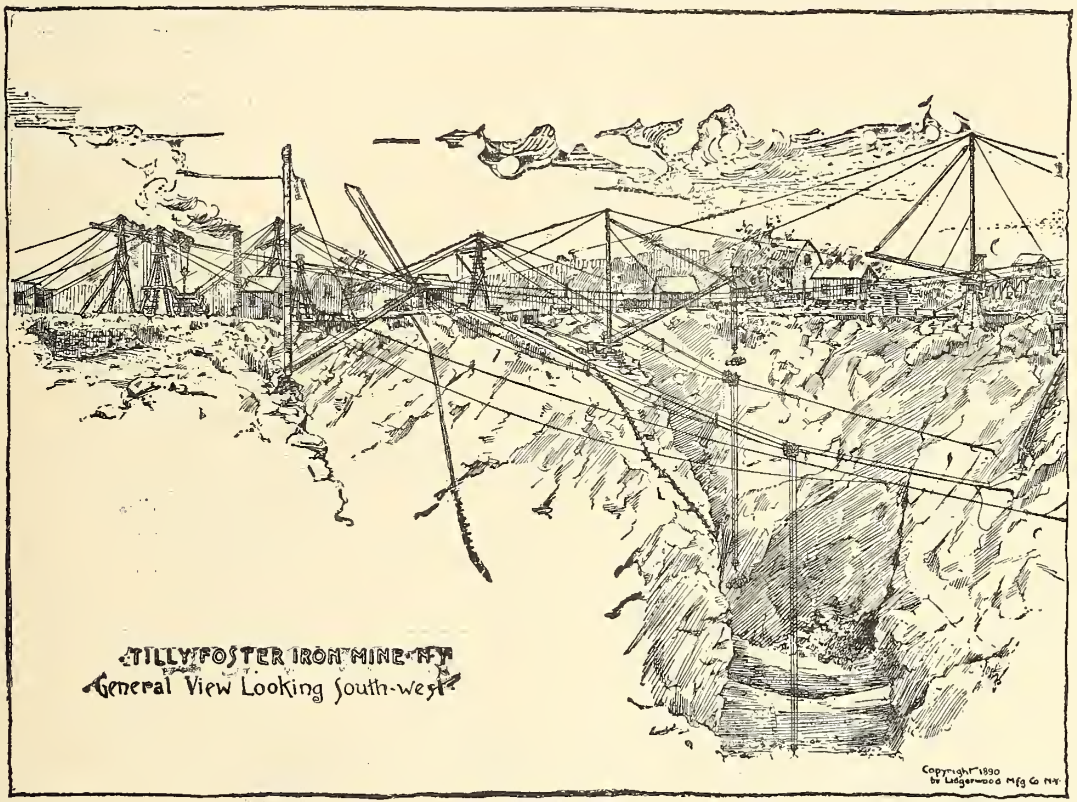
The cable carriage is shown at the top of the pit in the act of delivering a skip to the flat car on the railroad track.

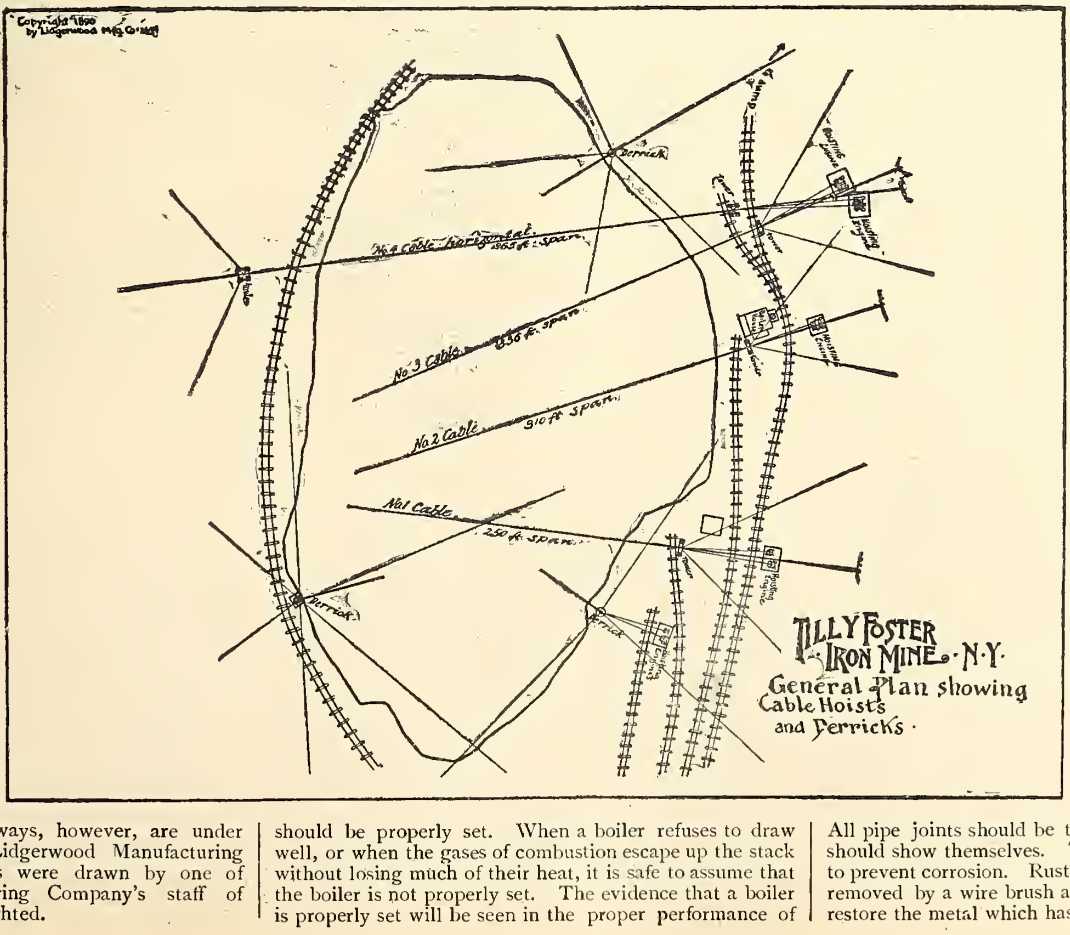
Fig. 5 shows a cross section near the incline cableway No. 3, and the horizontal cableway No. 4. A year ago the No. 3 cableway was remodelled with the Miller patent, and its working is much improved. The invention refers to the device which supports the hoisting or fall rope. It is shown in the smaller sketch, and consists of a simple wood and iron carrier which follows the carriage down the incline until stopped by a small steel button secured to an auxiliary rope placed above the main cable. A second carrier stops at a larger button further down the incline.

Fig. 6 is a good illustration of the carriage and the two fall rope carriers, one having just been stopped by a button too small to show in the drawing.

The cost of operating these cableways is something less than eight dollars per day, in the course of which an average of 150 trips can be made. Each load being about a cubic yard, makes the entire cost for hoisting, conveying and delivering, 5 cents per ton. In this work there are employed by the contractors, Messrs. Stephens and Arnold, about a dozen Lidgerwood hoisting engines of the latest improved pattern; in fact with one exception, the Lidgerwood engine is used to the exclusion of every other kind.

The cables were made by at least three different wire rope makers. All the cableways, however, are under patents controlled by the Lidgerwood Manufacturing Company. The illustrations were drawn by one of the Lidgerwood Manufacturing Company's staff of draughtsmen, and are copyrighted.


TILLY FOSTER IRON MINE N.Y.
General View Looking South-west
Copyright 1890 by Lidgerwood Mfg Co N.Y.



Practical Care of a Boiler.

The conditions most essential in a steam boiler are safety, large capacity, economy of fuel, durability, facility for inspection, cleaning and repair, compactness, and a first cost as low as compatible with these conditions. Some of these conditions may not be compatible with all the rest. When this is found to be the case the purchaser must decide which one he wants most, and those which he must sacrifice. It is most important that a boiler should be properly set. When a boiler refuses to draw well, or when the gases of combustion escape up the stack without losing much of their heat, it is safe to assume that the boiler is not properly set. The evidence that a boiler is properly set will be seen in the proper performance of its duties. That is to say, its capacity will be as great as it should be. Further evidence of proper setting will be dryness of steam, comparative coolness of gases of combustion as they enter the stack, and freedom from excessive deposit of sediment in places.

The water in a boiler should never be allowed to get too low; very often the first indication of dangerously low water in a boiler is the explosion of the boiler. Sometimes the earliest indication is a rupture of the whole shell, or rupture of the tube, or collapse of the flue without any explosion, or the indication of the water being dangerously low, may be sudden increase of pressure, red hot places on the shell, or bulging out, or coming down of part of the bottom.

The best place to connect the feed water pipe to a boiler is where the water in the boiler is the coldest. In this position the connection is less likely to leak and danger will be avoided.

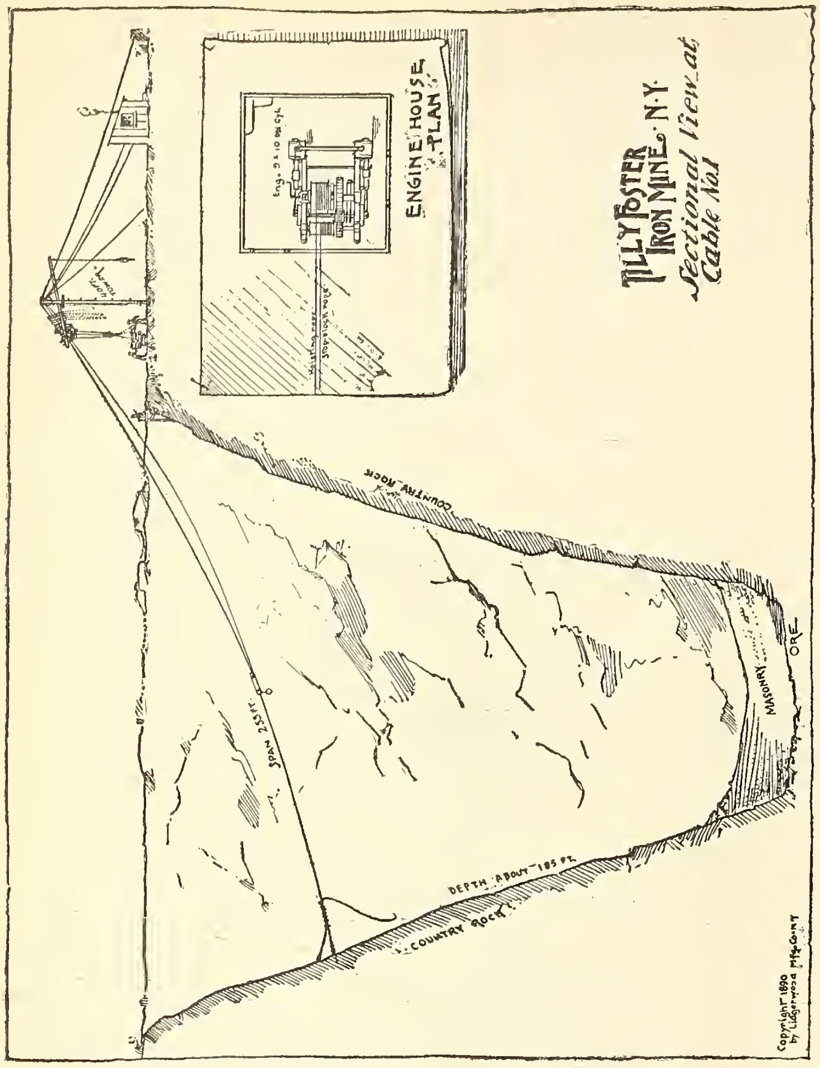
The life of a boiler may be greatly prolonged by a careful avoidance of overpressure, over heating, and corrosion, as these are the most detrimental influences to which a steam boiler is subjected.

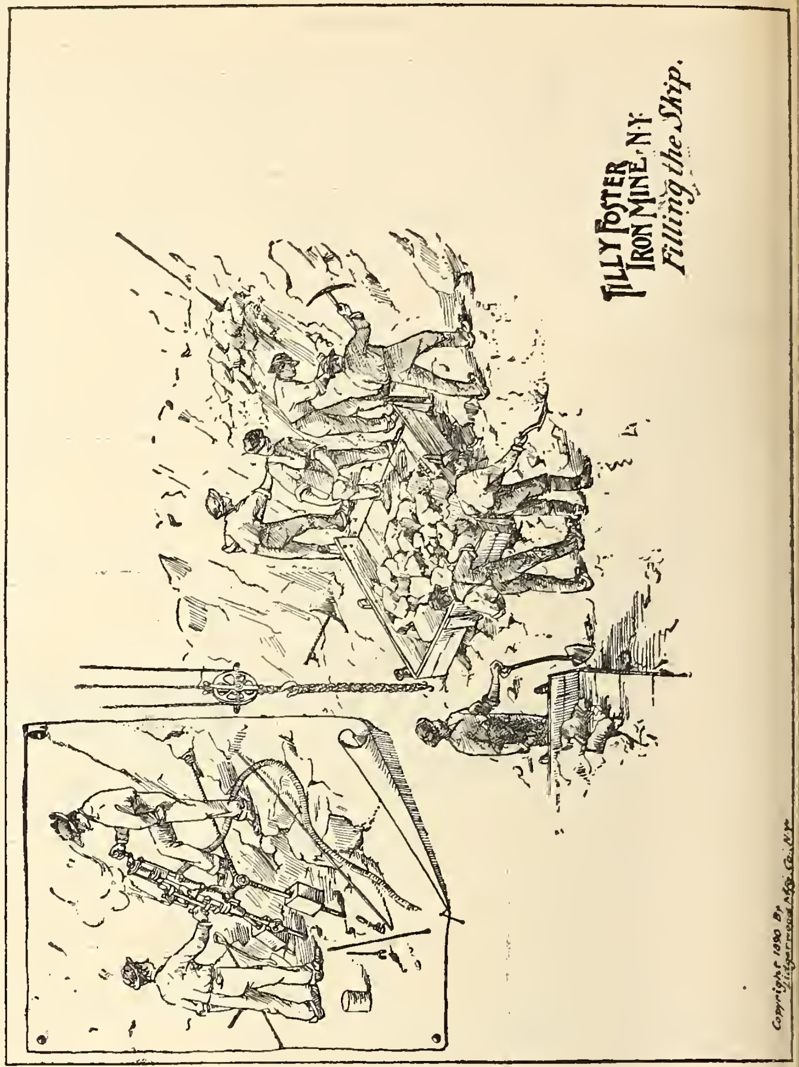
A boiler that has been out of use for some time should not be entered with a light without having first had the air which it contains driven out by a fan jet and a hose, or some other means.

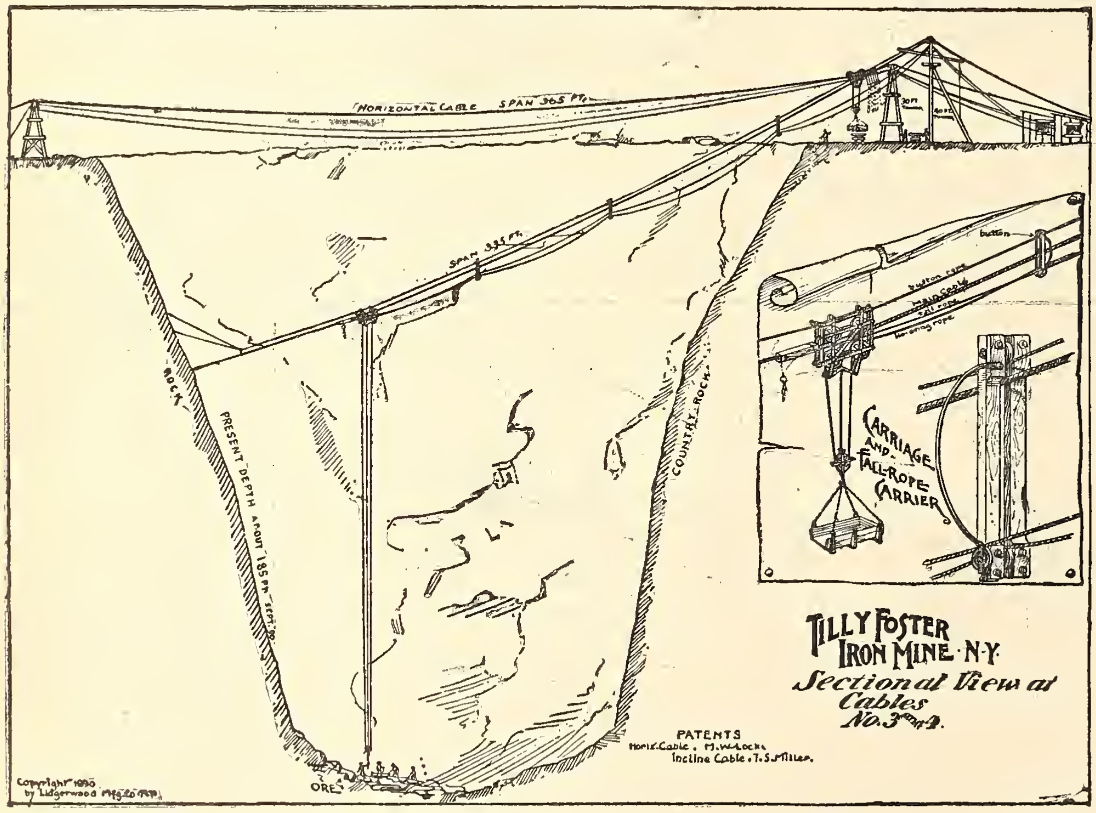
An engineer should be careful to ascertain that the steam gauge is recording the true pressure of steam carried on the boiler; he should test this with another gauge known to be correct, or with a steam gauge indicator of known accuracy. An engineer asked how he could prove that his boiler was not overtaxed with pressure. Well, the fact that it did not blow up was, in one sense, a proof that it was not overtaxed. But the best thing to do is to keep the pressure below the limit guaranted by the maker, and then such proof will not be necessary.

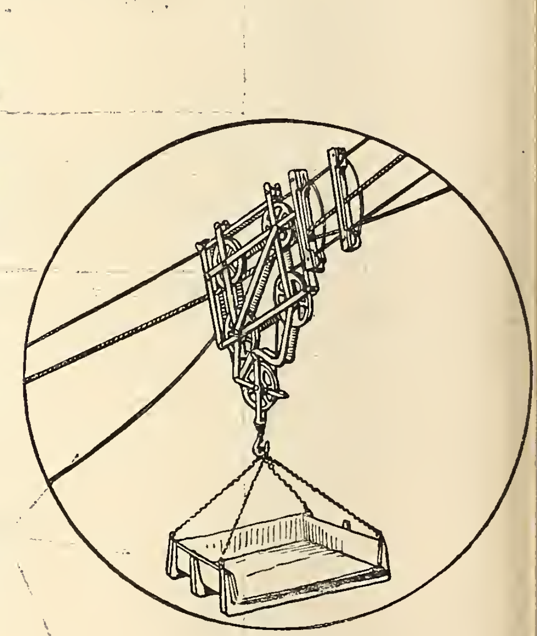
Some boilers explode, while others burst; yet explosion is only one way of bursting. Explosion is bursting with noise and violence, while rupture is bursting without either.

Minute inspection will tell what care a boiler has had, and it is important that means should be taken to ascertain that a steam boiler is being properly cared for. This inspection should show the interior free from deposits of sludge or scale and from fitting and corrosion; the exterior should be free from corrosion and bleeding; there should not be any great quantity of soot or ashes deposited in flues or water tubes; and the water itself should not bear any sign of having taken from the boiler any of its substance. The brickwork should be sound and in good shape, not falling down or even bulging, and not having any air leaks between the bricks. All pipe joints should be tight, and no leaks or fissures should show themselves. The best means should be used to prevent corrosion. Rust or discoloration may be readily removed by a wire brush and paraffin oil, but that cannot restore the metal which has been corroded away.


TILLY FOSTER IRON MINE. N.Y.
Sectional View at Cable No. 1
ENGINE HOUSE PLAN
COUNTRY ROCK
SPAN 255 FT.
DEPTH ABOUT 185 FT.
COUNTRY ROCK
MASONRY
ORE
Copyright 1890 by Lidgerwood Mfg. Co. N.Y.


TILLY FOSTER IRON MINE. N.Y.
Filling the Skip.
Copyright 1890 by Lidgerwood Mfg. Co. N.Y.


HORIZONTAL CABLE SPAN 365 FT.
SPAN 335 FT.
ROCK
PRESENT DEPTH ABOUT 185 FT.
COUNTRY ROCK
button
CARRIAGE AND FALL-ROPE CARRIER
TILLY FOSTER IRON MINE. N.Y.
Sectional View at Cables No. 3 and 4.
PATENTS
Horiz. Cable. M. W. Locke.
Incline Cable. T. S. Miller.
ORE
Copyright 1890 by Lidgerwood Mfg. Co. N.Y.



Improvements in Mechanical Engineering at Collieries.—The following is taken from a paper on Recent Improvements in the mechanical Engineering of Collieries, read by Mr. Emerson Bainbridge, before the English "Institution of Mechanical Engineers." "The trouble of travelling pumps in a sinking shaft has been avoided in a new winning in Yorkshire, by using a new pump devised by a Salford firm. It is suspended in the shaft by capstan ropes. The pump consists of a vertical steam cylinder with two hollow plungers attached, one on each side. The plungers are enclosed in two sliding barrels passing in the one piece downwards into one pipe of about double the diameter, which forms another hollow plunger with valve at the top. These barrels are connected to the piston of the steam cylinder above. The barrel into which the lower plunger works has a suction valve at the bottom of it, and is connected to the steam cylinder by tie bolts. The pump acts thus: As the piston and lower plunger rise the water follows the latter through the suction valves into the lower barrel, while at the same time the water in the two upper barrels is forced up the rising main. On the down stroke the water in the lower barrel is in turn forced through the delivery valve into the upper barrels, and thence to the rising main. Six of these pumps have been put into two sinking shafts near Doncaster. Together they are capable of raising 5,000 gallons of water per minute through a height of 300 feet.

"Steel rail guides in shafts at Nunnery Collieryare considered not successful. Counterbalancing in winding does not appear to be much considered in fitting up winding plants. Scroll drums seem presently the favorite device, but their great weight in a measure counteracts their effect. One of these at Ynysybwl Colliery varies in diameter from 18ft to 33ft, and coal is drawn therewith from a depth of 500 yards in 35 seconds. At a colliery in Derbyshire 170 yards deep, the speed of winding and changing is such that three cage loads are raised per minute.

"At Nunnery Colliery a Priestman oil engine is pumping 40 gallons of water per minute through 1,700 yards o pipe and a vertical height of 400ft. The quantity of oil used is from 1¼ to 1½ pints per actual horse power per hour. In another case the cost for labor and petroleum is 1¾d. per horse power per hour. To minimise the danger from fire the rising main is connected with four o Grimmell's sprinklers in the engine room, which act if the temperature reaches 155° Fahr

"Springs are in use at Nunnery Colliery to reduce the shock of the cages landing in the pit bottom. Four spira springs are used to each cage, and at the landing they yield about two inches, the compression diminishing by half as the cage rests, and increasing again to two inche as the load is placed upon the cage. These springs als decrease the strain at the commencement of the winding

"Elliot's lubricator for hutch axles consists of a laye of felt within a cap of steel. The felt is said to be capable of absorbing sufficient oil to last for three months."

New Feature in Mine Prospecting and Development—The Sullivan Diamond Drill Operated by Electricity.

The increasing employment of electricity in mining operations has opened a new field for the diamond prospecting drill. This drill has for a number of years been widely used, driven by steam or compressed air, and sometimes by hand or belt power, in nearly all the mining regions of the country. Its use brings to the surface a solid core of all the rock and mineral formations, showing accurately the depth of the mineral deposit, its quality and thickness. The most recent improvement in this class of machinery consists in adapting the diamond drill to be run by electricity.

The electric diamond drill manufactured by the Diamond Prospecting Co., 15 and 17 North Clinton street, Chicago, has been mentioned in the scientific papers in the course of its development. The engraving presented herewith represents the perfected type of this drill, which has been in practical use for some time.

One of the difficulties in the way of the use of the diamond drill underground, and in rough mountainous localities, has been to get power to the machine, as the nature of the surface of the country may make it impracticable to get heavy boilers and machinery close to the mine opening. Even where this can be done, there still remains the great difficulty and expense of getting fuel to the boilers, if the mine opening is located, as often happens, on a mountain top and where timber is scarce; and a further difficulty arises where compressed air is not used as motive power, from the fact that the use of steam underground, besides being unsatisfactory for power and uncomfortable for the men, is often a source of great expense owing to damage caused by the action of the exhaust steam on the mine timber and rock.

The Electric Diamond Drill avoids all difficulty in these respects, and will permit core drilling to be undertaken to advantage in places where it has hitherto been impracticable. The dynamo can be located near an engine or water wheel at any distance, and the power carried easily and inexpensively to the drill, which can be on a mountain top, in a deep shaft, or in any part of the mine. Any constant potential electric current of sufficiently low voltage for safe use underground and of sufficient capacity to deliver three horse power at the drill motor, can be used. The current for running the drill can be taken from an electric plant already installed for lighting, hoisting or other mining operations; or if no electric plant is in use for such work, a small dynamo and water wheel or engine can be put in purposely for the drill at slight expense.

The device for feeding the drill bit forward in this machine is a combination of the ordinary gear-feed, with a friction clutch intervening, which not only avoids danger to the diamonds, but also results in the most efficient and economical drilling. All parts of the machine, including motor, drill, pump and hoisting drum are conveniently arranged on a single frame, which can be mounted on trucks for moving about the mine. Switches, resistance box, etc., are provided for safety and convenience.

The Sullivan Electric Diamond Drill is the first and only electric diamond drill that has been put into practical operation; and that it has been successful in the new field is demonstrated by the following letter, which will be interesting to managers of mining companies who are now considering the advisability of introducing an electric power plant:—

FRED. G. BULKLEY,
Gen'l Manager, Aspen, Colo.
J. G. WHEELER,
President, 64 Wall St., New York.

THE ASPEN MINING AND SMELTING CO.

ASPEN, COLO., March 2nd, 1891.

THE DIAMOND PROSPECTING CO.,
17 N. Clinton Street, Chicago, Ill.

Gentlemen:—We have been using for several months one type "R" Sullivan Diamond Drill, the first one manufactured, (at the request of the writer) and find that it does satisfactorily all the work required of it.

The drill is operated by a three-horse power Thomson-Houston Electric Motor, and is used for prospecting the country rock adjoining old drifts, levels and stopes, so that considerably more time is lost in moving the drill from place to place and setting it up within the confined limits of mine workings, than would be the case were we operating upon the surface. We use two bits giving us either a 15-16 inch core, or 1 and 15-16 inch core as we may desire.

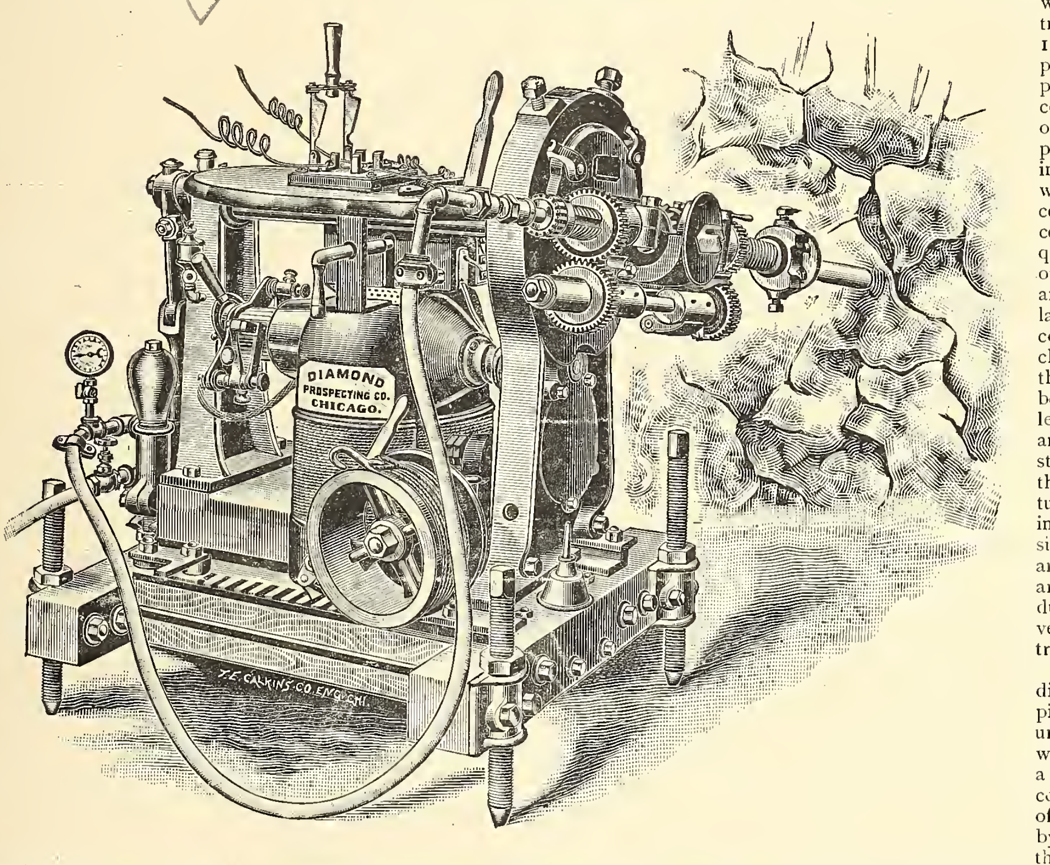
The rock penetrated consists of rather hard limestone, containing in places bands of very tough siliceous rock, while at other points it is badly shattered and intersected with clay seams. The progress made varies from 6 to 28 feet per shift of 8 hours; 15 feet per shift, including all time lost in moving, setting up and drawing cores, being the average. We are sending in holes at every angle with the horizon but seldom penetrate to a depth greater than 100 feet.

During the month of February last our drilling work was conducted intermittently, the total amount drilled being 577.5 feet, progress being made at the rate of 1.66 feet per hour, loss in carbon amounting to 1 and 41-64 carats, and the exact cost including all expenses being 68 cents per foot; of course, much more time is taken up in moving and setting the drill, and in drawing cores, than in actual boring operations.

Upon two occasions we have found rock so badly shattered and intersected with large clay seams and "vugs" that the drill could not be operated to advantage, but under all ordinary conditions we are enabled to penetrate the rock, the only difficulty being that the core comes out in very small fragments and is sometimes difficult to save. With the 15-16 inch bit, core fragments vary from two to fourteen inches in length. With a larger bit much longer fragments are obtainable.

We feel entirely satisfied with the information gained by the use of the machine, which has more than paid its cost, while some discovery of ore has made the undertaking profitable.

Yours very truly,
FRED. G. BULKLEY, General Manager,
The Aspen Mining & Smelting Co.


DIAMOND PROSPECTING CO. CHICAGO.
T.E. CALKINS CO. ENG. CHI.

Fireless Locomotives for Mines.—C. Rolland has constructed a fireless locomotive for use in the collieries of Mons, Belgium. It is provided with a tank holding 19½ cubic feet of water heated to 205° C.; that is to say, at an absolute tension of 16 atmospheres. The heating is effected by means of steam jets in a boiler at the surface. This suffices for an ordinary run of 1½ to 2 miles. By the employment of this superheated water, a considerable amount of work may be stored in the form of heat in a comparatively small space, and this heat gradually evaporates the water required for driving the engine. The reservoir has a capacity of 19.43 cubic feet, the locomotive works with 6 horse power at a speed of 6½ feet per second. Thus, working day and night, one locomotive takes the place of 12 to 18 horses, and also renders a number of workmen unnecessary. According to an estimate for a mine 600 yards in depth, with a haulage distance 600 yards in length, the cost of haulage with the fireless locomotive is £196 annually, whilst that with horses is £440. Thus there is an annual saving of £224, Besides the direct economy, there are other advantages accruing from the use of the fireless locomotive in collieries. These are: (1) absolute safety from the dangers and discomforts of fire and smoke; (2) preservation of the mine in hygienic condition on account of the absence of horses and their stables; (3) absence of all the incidental expenses associated with horse haulage; and (4) low consumption of of steam, and good ventilation caused by the movement of the air current created by the locomotive. The lightest type of locomotive built at the Hohenzollern works for this use is 9,920 lbs. The author's locomotive only weighs 6,610 lbs. For a track with a gauge of 23.62 inches, the breadth of the engine is 32·29 inches, and its length 9 feet 10 inches. An automatic steam pressure regulator is provided, and also means whereby the driver can control the working. In conclusion, the author proceeds to calculate the efficiency of the engine.

◆

A Smoke-Consuming Appliance.—Among the more recent appliances for the mitigation of the smoke-nuisance is one recently invented and now being brought into the market by Mr. John Payne, manager of the firm of George Wright & Co., Rotherham, Eng., ironfounders. The appliance consists of a simple arrangement on each side of the furnace which reduces the space for the consumption of fuel, and forms a channel along which air passes into a hollow bridge, where it is discharged in a heated condition. This heated air, intermixed with the smoke and gas as it leaves the furnace, converts it more or less into a flame, thereby increasing the heat-power acting on the boiler producing steam. The inventor claims that fuel to the extent of 20 per cent. is saved, that there is a thorough consumption of smoke, and that the appliance has the advantages of inexpensive fixing, which may be adapted to existing boilers, whilst no special skill is required on the part of the men employed in firing. The appliance has been patented, and already considerable orders have been received by the firm for its manufacture. The firm are exhibiting it in actual use at their works.

◆

Coal-Washer.

M. Max Evrard† describes a modification of the ordinary piston or hydraulic jigger having an arrangement for scraping the surface and removing the top of the washed layer of material under treatment. A rectangular sieve 10 by 3½ feet is fixed on a pyramidal hutch, and has a plunger-box on one side, and a continuous, adjustable discharge opening on the other. The plunger is circular and smaller in area than the sieve. It is worked by an adjustable eccentric. A scraper-frame receives a slow forward and quick return motion by means of a counterweighted lever and cam. The frame is larger than the sieve, and is connected with the slide which closes the feed-hopper, so that the fresh material is fed at the beginning of the stroke. The length of stroke is 20 inches, and the teeth on the forward stroke drag the finer parts of the material forward, and disturb the material six times during its travel along the 10 foot sieve. The suspension rods are arranged so that the scrapers are lifted clear of the material during the return stroke, unless very dirty material is being treated.

The dirt from the hutch is discharged at intervals through pipes in the bottom. When unclassified coal is treated, the washed material is subjected to a final screening, giving lump coal and slack with 10 per cent. of ash. The fine coal, raked off by the last and deepest teeth of the scraper, is pushed over a draining-apron into wagons.

These machines are worked at 43 to 45 strokes per minute with the expenditure of 4 to 6 horse-power per double machine, and average 15 tons per hour. This plant has been or is being adopted at six collieries in France, four in Belgium, and three in Spain.

◆

The Biggest Stationary Engine in the World.—At the Friedensville Zinc Mines, six miles south of Allentown, Pa., there is in operation the largest stationary engine in the world. During the past few months it has pumped dry, by under-ground drainage, nearly every ore pit, spring and small stream within a radius of five miles. The engine is known as the "President." is of 5000 horse-power, and is run by 16 boilers. At each revolution of its ponderous wheels a small stream is thown out, the number of gallons raised every minute being 17,500. The driving wheels are 35 feet in diameter and weigh 40 tons each. The sweep-rod is 40 feet long. The cylinder is 110 inches in diameter, while the piston-rod is 18 inches in diameter and makes a 10-foot stroke. The engine has a ballast box capable of holding 60 tons, and to feed the boilers 28 tons of coal are required daily. On the engine is the largest nut in the world. It is hexagonal in shape, and weighs 1,600 pounds. To tighten or loosen this nut 20 men are required, while the wrench that fits it is 20 feet long. From the end of the walking beam of the engine to the bottom of the shaft the distance is 300 feet. The masonry on which the engine rests is 108 feet deep, some of the foundation stones weighing five tons. The engine operates four pumps, three of which are 30 inches in diameter, and the fourth 22 inches.

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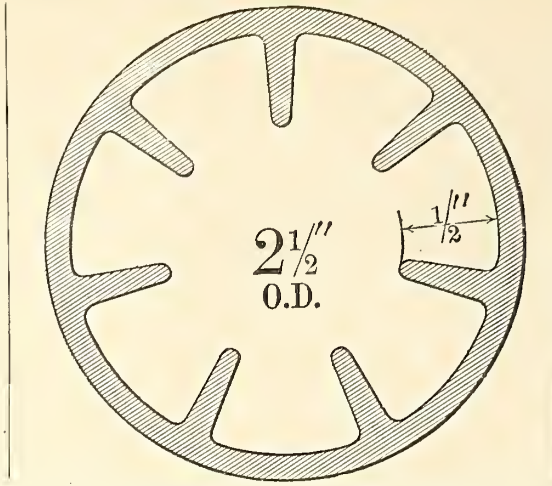
† Bulletin de la Societe de l'Industrie Minerale, vol. iii. p. 317.

Serve's Patent Ribbed Boiler Tubes.

Below are appended the results of tests made at Elizabethport, N.J., of Serve's ribbed boiler tubes, with comparisons with the ordinary plain type. These show that there is a decided economy in their use as far as stationary boilers are concerned. A very significant fact noticeable in the data is that the temperature of the chimney is very much reduced. With natural draft the average temperature of the chimney gases where plain tubes were used was about 682°; on the other hand, when the ribbed tubes were employed, this temperature was reduced to 396° on one day's test, and 492° on another. In the first of these two days the natural draft was for some reason or other less than usual, and therefore the passage of the gases was slower, and that probably accounts for the discrepancy of nearly 100° which is found in the figures for the two days. When a draft of one-half inch of water was used, the average temperature of the smoke box gases for two days' run with plain tubes was about 830° Fahr., and with the ribbed tubes the temperature averaged about 454°. With a forced draft of ⅞ in. water the temperature of these gases when plain tubes were employed rose to an average of 956°, whereas, with the ribbed tubes and the same forced draft the average temperature of these gases was but about 511°. It will thus be seen that there was a decided saving by the ribbed tubes when a moderately forced draft was employed. There seems to be no good reason why a similar economy, differing only in degree, should not be obtained with the more severe forced draft common in locomotive service.

The records of fuel economy show the ribbed tube in the same favorable light. The pounds of water evaporated per pound of coal with natural draft and plain tubes averaged 5.07½ lbs., whereas, with ribbed tubes under the same conditions it was 7·37 lbs. With a forced draft of ½ in. of water and plain tubes it was 5·99 lbs., and with ribbed tubes 7·55 lbs., and when the forced draft was increased to ⅞ in. of water the average for plain tubes was 4·68 lbs., and 6·75 lbs. for ribbed tubes, the average economy of all the tests being about 30 per cent. in favour of the Serve ribbed tubes.



	Date of trials, April, 1891.	Draft in inches of water.	Average temperature of chimney gases per pyrometer.	Average temperature of feed water.	Pounds of feed water evaporated during trial.	Pounds of coal fired during trial.	Pounds of ashes and unconsumed coal on grate and in ashpit at end of trial.	Pounds of picked out unconsumed coal in this.	Pounds of ashes in ashpit and on grate at end of trial.	Pounds of ashes per 100 pounds of coal.	Pounds of combustible consumed during trial.	Pounds of water evaporated per pound of coal fired.	Pounds of water evaporated per pound of combustible.	Pounds of combustible consumed per square foot of grate in trial.	Weather.	Barometer.	Outside temperature.
PLAIN TUBES.	6	⅛	679.05	191.03	4230	855	194				676	4.95	6.28	12.05	Clear day, very light breeze.	29.91	42°
	7	⅓	685.15	189.54	4475	861	210½	119	91½	9.05	665	5.20	6.73	11.87	Clear day, still.	29.98	42°
	8	½	800.6	186.72	8325	1388	239¾	97¼	142½	9.27	1162¼	5.997	7.16	20.17	Clear day.	30.23	48°
	9	½	856.4	186.60	8380	1400	259¾	107½	152½	9.84	1154¼	5.985	7.26	20.61	Clear, very light breeze.	30.46	51°
	10	$\frac{13}{16}+\frac{1}{32}$	990.	187.30	8460	1777	298	143	155	7.99	1493	4.76	5.66	26.67	Dull, no rain.	29.53	44°
	11	⅞	922.73	186.75	8190	1780	369½	173	196½	10.15	1425	4.60	5.74	25.44	Rainy day, coal wet, ashes damp.	30.17	53°
RIBBED TUBES.	15	$\frac{1}{8}$ less $\frac{1}{64}$	395.6	198.11	5025	745½	266¼	183	83¼	9.3	493¼	6.74	10.10	8.80	Fair.	29.78	73°
	16	⅛	492.45	194.27	5250	655½	164	75¼	88¾	11.01	505½	8.01	10.38	9.02	Fair.	29.98	60°
	17	½	468.78	186.3	10830	1487	325½	141¼	184¼	11.25	1176	7.28	9.21	21.	Clear.	30.09	62°
	18	½	438.22	191.77	11050	1394½	299¾	144	155¾	10.08	1108¾	7.92	9.96	19.80	Clear.	29.83	59°
	20	⅞	502.	179.1	12180	1808¾	375¼	172¾	202½	10.34	1447½	6.73	8.41	25.84	Clear.	30.15	63°
	21	⅞	519.68	181.	12200	1800	350	123½	226½	11.60	1464	6.77	8.33	26.14	Cloudy.	30.36	53°
	23	$1\frac{3}{16}$	742.73	183.21	13935	1879½	339	114½	224½	11.037	1554½	7.41	8.32	27.57	Clear.	29.56	70°
	25	$1\frac{9}{16}$	678.33	170.	14000	2144½	342¾	160¾	182	7.93	1815¾	6.52	7.71	32.41	Fair.	29.58	52°

THE RESULT CONDENSED.

Pounds of coal consumed per 100 pounds of water evaporated.			Economy of Coal, %	Increase in steam generated.	Increase by Serve's tubes over plain tubes.	Total evaporation.	Evaporation per pounds of combustible.	Extreme evaporation in 8 hours.	DURATION OF TRIALS.	Pounds of feed water evaporated in both tests		Average temperature of feed water.		Pounds of coal used in both tests.		Pounds of water evaporated per lb. coal.	
Draft.	Plain Tubes.	Ribbed Tubes.								Plain Tubes.	Ribbed Tubes.	Plain Tubes.	Ribbed Tubes.	Plain Tubes.	Ribbed Tubes.	Plain Tubes.	Ribbed Tubes.
Natural Draft ⅛	19.72	13.65	30.83%	18.03%	Natural Draft ⅛	18.03%	57.54%	8460 lbs. For Plain Tubes.	Two 8-hr. tests with natural draft, ⅛ in. water......	8705	10275	190.28	196.19	1716	1401	5.08	7.35
Forced Draft ½	16.7	13.21	21.08%	30.97%	Forced Draft ½	30.97%	32.68%	14000 lbs. For Ribbed Tubes.	Two 8-hr. tests with forced draft, ½ in. water......	16705	21880	186.66	189.03	2788	2881.5	5.98	7.60
Forced Draft ⅞	21.37	14.8	30.74%	46.46%	Forced Draft ⅞	46.46%	46.84%	Increase. 65.5%	Two 8-hr. tests with forced draft, ⅞ in. water......	16650	24380	187.02	180.05	3557	3608.75	4.68	6.75
									One 8-hr. test with forced draft, $1\frac{3}{16}$ in. water.....		13935		183.21		1879.5		7.41
									One 8-hr. test with forced draft, $1\frac{9}{16}$ in. water.....		14000		170.		2144.5		6.52

Each day's trial lasted 8 hours. 32.35 lbs. of wood and 150 lbs. of coal were used to kindle the fire and to raise steam to 70 lbs. pressure, after which the trial immediately commenced. Steam was kept at 70 lbs. pressure and the water level at 7 inches in the glass as nearly as possible, and both were at these points at the end of the trial. In trial of 25th alone steam was kept at 100 lbs. pressure in order to obtain the high draft and dry steam. The water level was also about 3 inches in the glass. The soot scraped out of the plain tubes after the 6 days was 2¼ lbs. That scraped from the Serve tubes after the 6 days' trial was 3 lbs. The last 2 days' trial was with ribbed tubes alone, to determine the limit of efficiency in comparison with the plain tubes, which was reached with the latter at ½ inch draft pressure.

The quantities and results are taken as they are marked on the daily logs without any calculated reductions. The boiler was a usual upright tubular of 42 inches diameter with 36 inch furnace, 24 in. high and with 63 tubes 2½ in. O. D. × 6 feet long. 7 square feet grate surface. 287 square feet fire surface.

A Progressive Company.—The Jeffrey Manufacturing Company, whose success in the manufacture of mining machinery has been so remarkable, has opened an office and salesroom at 48 S. Canal Street, Chicago, where they will keep on hand a large stock of sprocket wheels, and a full line of roller and detachable chain belting, and all their special appliances for the rapid handling of materials either in package or bulk. Their specialties include all kinds of conveyors and elevators for handling coal, ores, grain, stone, coal pilers and railroad coaling stations. Their detachable chain belt will fit any standard make of wheels. The Jeffrey drill and coal mining machines operated either by electricity or compressed air, are pronounced by mining engineers to be the best machines yet devised for the purpose. The shops from small beginnings now cover five acres and owing to the rapid increase of their business, they have recently purchased three acres adjoining their works, on which, during the coming summer they will erect additional shops. Mr. John H Gregg, who has a wide experience in their special line, is the engineer in charge of the Chicago branch.

The Profits of the Bessemer Process.—Sir Henry Bessemer himself is authority for the following remarkable statement of the profits of the steel process which bears his name. He says:—"Some idea may be formed of its importance as a manufacture, when I state the simple fact that on the expiration of the fourteen years term of partnership of our Sheffield firm, the works, which had been greatly increased from time to time entirely out of revenue, were sold by private contract for exactly twenty-four times the amount of the whole subscribed capital of the firm, notwithstanding that we had divided in profits during the partnership a sum equal to fifty-seven times the gross capital; so that by the mere commercial working of the process, apart from the patent, each of the five partners retired after fourteen years from the Sheffield works with eighty-one times the amount of his subscribed capital, or an average of nearly cent. per cent. every two months—a result probably unprecedented in the annals of commerce."

Cage-Props.—Mr. E. B. Clarke, (Proceedings of the Federated Institution of Mining Engineers, vol. i., p.p. 209-211), describes the Strauss system of colliery cage-props which has been in use for over three years in Belgium. During a trial of two months, 78 cages per hour were drawn, and this number was increased to 88 per hour after the adoption of these props. This is equal to from 1,000 to 1,100 tons per day with two deck cages. The prop is pivoted to a link, and rests on a steel block. The link is hung on a fixed pivot and is drawn back by a lever, so as to withdraw the prop when it is desired to lower the cage. The withdrawal can be performed with the whole weight of the cage resting on the prop. The ascending cage knocks the prop up as it passes, and then falls back on it.

IRON STEEL AND HEAVY METALS.

Iron and Steel.

Montreal, May 26, 1891.—During the past month the Scotch pig iron market has fluctuated to a considerable degree, and especially during the past two weeks has been in a very excited state. The comparatively small quantity in public yards enables speculators to control the market much better than they have hitherto been able to do, and the excitement in the present instance is due to a squeeze on the "bears." Almost all the warrants for immediate delivery are in the hands of London speculators, and they have taken advantage of their position, and forced buyers to cover themselves at very high prices. Warrants, which a month ago were selling at about 45/-, have gone as high as 54/3, but the last reports show that a drop has again taken place, the market closing on 25th inst., at about 52/6. That the advance in the price of Scotch warrants is entirely speculative may be seen by comparing them with Middlesbro' and Hematite irons, which have hardly advanced at all during the past few weeks. This movement of the market has injured legitimate trade very much, as ordinary buyers are simply holding off until prices come down to their normal figures. It is expected that the next week or two will see a return to the figures that were current a few weeks ago.

Makers' brands have not changed to any extent, and a steady business has been done, especially on the Continent of Europe. On this side of the Atlantic, however, the demand has been very small and the quantity of iron that has arrived by the first steamers cannot compare with what used to be shipped when buyers in Canada were restricted almost altogether to Scotch iron. The amount of iron in yard or on dock here is limited, and prices have been about as follows: "Summerlee" $21.50, with common brands such as "Carnbrae" and "Eglinton" at $1 to $1.50 less.

American brands have not fluctuated in price to any extent, and Western founders are in the meantime supplying their wants from that source. There is no doubt, however, that prices are abnormally low, and a considerable advance is expected at a very short date. There is no profit at the prices that are now being quoted, and some of the Northern furnaces will be blown out rather than continue to sell at present figures.

Finished iron continues low in price and ordinary bars are selling as before at $2 to $2.15 according to quality. Hoop iron and band iron are also extremely low.

The feature of the local market during the past month has been the extraordinarily low prices of cut nails. We understand this is due to the breaking up of the Association which formerly existed among nail manufacturers. Nails have been sold down as low as $2 per keg, although the ordinary price is about $2.10. It must be obvious that this cannot last long, and it will be better for all concerned if some arrangement was come to to prevent such cutting in future.

Tin plates for immediate delivery are still high in price, but for July and August shipment from England considerably lower figures are now asked. It is understood, however, that several of the tin plate works will close down after their contracts for American shipment are finished in June. They have been running up to their fullest capacity for the past year at exceptionally high prices, and they feel that they can take a rest rather than manufacture at the low prices which will now be current.

Canada plates are held in Montreal at $3 per box, and it is hardly likely that any will be shipped from England before August, when prices will doubtless be somewhat lower.

Business in the other departments of the metal trade continues quiet without very much variation in prices.

London, May 12, 1891.—There is not much change to note in the general situation, but it appears to be a fact that the upward course of Scotch warrants has to some extent stimulated legitimate buying, and has also rendered producers rather firmer in their views. This steadier tendency has been confirmed and emphasised, also, by the considerable decrease in Cleveland stocks, and the continued withdrawals from Connal's stores at Glasgow. The squeezing of the "bears" has gone on very steadily, and on their covering purchases the operators of that ilk have had to pay pretty smartly. The London ring have the keys of the situation, and have "let out" warrants at their own prices. It is asserted that the squeeze will not be over for some time to come—indeed, we have communications from enthusiastic "bulls" predicting much higher figures than those which have yet been reached. This may or may not be correct, but in any case it is obvious that the whole thing is a piece of market manipulation which has but a slight relation to the actual state of the trade. Yet it has to be remembered that these fluctuations *do* affect legitimate transactions, and that the effect, so far, has been to give some stimulus to purchasing. There is rather more being done in many branches, but work is being much hindered in most places by the effects of the influenza epidemic. Pig iron is rather steadier all around, owing to buying by consumers, who are believed to be quite bare of stocks, and the better indications afforded by the Cleveland returns for April. Smelters are holding out for 1s. or 2s. more per ton, and in most cases are obtaining the advance. In the London warrant market there have been considerable purchases by the bears, many of the Glasgow operators having to come here to secure warrants for covering their bear sales. It is understood that one of the largest oversold accounts has been dealt with "by arrangement;" but in other cases it is believed that fuller prices will have to be paid.

Scotch Pig Iron Warrant Market.—Following is our usual statistical table:—

	1891.	1890.	1889.	1888.	1887.
Scotland.					
Price of Scotch warrants, May 5	48/11	45/2	44/1	38/1½	41/-
Furnaces in blast in Scotland, May 5	57	87	76	87	81
Quantity of iron in public stores	511820	779283	1029948	977112	869907
Shipments of Scotch pig iron for week ending May 2.	5379	9808	9562	8182	6649
Do. since beginning of year	77036	150469	141790	132428	137559
Middlesbro' iron imported at Grangemouth, week ending May 2	8346	2440	8340	6380	7336
Do. since beginning of year	125016	44929	131740	122101	127105
Cleveland.					
Price of Middlesbro' No. 3 warrants on May 5	39/9	44/7½	39/-	31/-	33/4½
Furnaces in blast in Middlesbro' district	91	105	103	96	92
Quantity of iron in public stores*	118916	129582	240988	310581	335925
Shipments of pig iron from Middlesbro' for week ending May 2	20100	16990	25924	21484	17166
Do. since beginning of year	271536	230827	339232	316385	267759
West Cumberland and North Lancashire.					
Price of hematite M/Nos. warrants	49/6	54/4½	49/-	41/3	42/9
Furnaces in blast in W. Cumberland and N. Lancashire	39	47	47	50	54
Quantity of iron in public stores†	160127	331299	422307	436882	318140
Shipment of hematite iron for week ending May 2	8295	14826	8166	8257	11969
Do. since beginning of year	175925	193944	188463	156251	195337

* Connal's & N. E. Rly. Co's.

† Workington, Maryport, and Barrow.

New York, May 26th, 1891.—Business is in a stagnant condition in the iron market owing to the strike of the foundrymen and house-smiths. No transactions of any importance have transpired, and the whole portion of the trade of which New York is the centre, is at a standstill. There is some prospect however that this state of affairs will not last very long, as the strikers begin to show signs of weakening. The lumber boycott, which has been a strong help to the house-smiths, is already broken, while among the foundrymen, the moulders who went out merely in sympathy, have about made up their minds to return to work. The pig iron market is very quiet, but is also very steady. Prices have shown no signs of weakness since the beginning of the labor troubles here, the only effect having been deferred deliveries. In the case of Southern irons even, there has been a marked stiffening in prices, and it is now impossible to secure any standard brand of No. 1 X iron for less than $17.50. This firmness is due to the increased demand for this class of iron in the West, and the great reduction of stocks at Southern furnaces. Indeed there is said to be scarcely any banked there at the present time. We quote prices as follows: Northern, No. 1 X, $17.50 @ $18; No. 2 X, $16.50 @ $17; Southern, No. 1 X, $17.50 @ $18; No. 2 X, $16.50 @ $17. The volume of business in spiegeleisen and ferro-manganese has been very small, and many dealers report no inquiries. The situation in the ferro-manganese market abroad continues unchanged, and prices here remain at the same level. We quote: Spiegeleisen, 20%, $27.50 @ $28.50; ferro-manganese, 80%, $64 @ $65. Some sales have been made at the latter figure.

Cleveland, O., May 23, 1891.—The reserve stocks of iron in this vicinity have been thoroughly cleaned up and there is an immediate want of available pig metal for conversion into mill and foundry iron necessary for building operations already under way, and some of the furnacemen knowing that the cutting off of any manufactured article carries with it a shrinkage in demand, hope to further stimulate the present demand for pig iron by resuming production, when feasible, even though there may be an actual loss in first transactions, trusting to subsequent business to "even up." It must be said, however, that this impression is by no means general in the market, and that there are a majority of producers who say that they will certainly remain out of blast until iron can be sold at a profit, no matter how long they have to wait for it. Manufactured iron, which a few weeks ago experienced a slump, is up again, bar iron selling at about $1.65. Sales were reported not long ago at $1.55 at the mill, so that the later price is a decided improvement. Sheet iron, which sold as low as $2.70 for No. 24, is also selling more firmly, and there is considerable demand for channels and other forms of combination iron for building purposes and structural work generally. The strike of the ore handlers continues, and there is little prospect of its early settlement. The dock companies, in self-defense, cannot pay more here than is paid at adjacent and competing harbors for the same class of work, and as the difference between employees and employers is about 30 per cent., it will be seen that the prospect of an agree ment is very slim.

Copper.—The American copper market has been weakening off, and it is understood that recent sales of Lake copper have been made at 12¾c., and bids for further quantities solicited at lower prices. There seems to be no doubt that the large lake companies, as well as the smaller mines, are very anxious to make sales, and a knowledge of this fact has influenced the market, with the result that lower prices had to be accepted. No large transactions have as yet taken place at the lower figures, buyers appearing to be under the impression that lower prices will be accepted later on, and consequently holding off as much as possible. Other kinds of copper have declined in sympathy, Arizona bars being more freely offered, and Arizona ingots being now obtainable below 12½c. In the London market there has been some advance lately, owing to speculative buying, but the movement was limited to G. M. B. copper. Prices reached £52 12s. 6d. spot, and £53 7s. 6d. futures, bu have eased off again to about £52 spot, and £52 10s. for futures. Statistics to hand show a decrease of 3,000 tons for the first half of May, which decline is chiefly due to the withdrawal from warehouse of large quantities of furnace material. We quote: English Tough, £54 10s.; Best Selected, £56 10s.; Strong Sheets, £59 10s.; India Sheets, £57 10s.; Yellow Metal sheets, 5½d.

Lead.—Quite an advance was experienced in New York last week, a sudden demand having sprung up, and 4.35c. has been bid for large quantities, and even 4.40c. for futures. Consumers seem to be badly stocked, and should the trade show any new signs of activity throughout the country, higher prices may rule for some little time. Smelters are offering but limited quantities, and as far as known, large stocks are not in existence anywhere. The London market is somewhat weaker, and late quotations are: English, £12 10s.; Spanish, £12 10s.

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The American Iron and Steel Trade.—The annual statistical report of the American Iron and Steel Association for 1890, just issued by Mr. James Swank, contains a great deal of most valuable information. The growth of some of the leading products is set forth in the following table. The tons are of 2,000 lbs., and the kegs of nails are 100 lbs. each:—

Net Tons of 2,000 lbs. (except Nails).

——	1887.	1888.	1889.	1890.
Pig iron, including spiegel	7,187,206	7,268,507	8,516,079	10,307,028
Spiegeleisen	47,598	54,769	85,823	149,162
Bessemer-steel ingots	3,288,357	2,812,500	3,281,829	4,131,535
Bessemer-steel rails	2,354,132	1,552,631	1,691,264	2,091,978
Open-hearth steel ingots	360,717	352,036	419,488	574,820
Open-hearth steel rails	19,203	5,261	3,346	4,018
Crucible-steel ingots	84,421	78,713	84,969	79,716
Rolled iron, except rails	2,565,438	2,397,402	2,576,127	2,804.829
Rolled steel, "	902,156	1,201,885	1,584,364	1,829,247
Iron rails	23,062	14,252	10,258	15,548
Pig, scrap, and ore blooms	43,306	39,875	36,260	30,783
Kegs of iron cut nails	3,419,578	2,170,107	1,778,082	1,806,130
Kegs of steel cut nails.	3,489,292	4,323,484	4,032,677	3,834,816
Kegs of wire nails	1,250,000	1,500,000	2,435,000	3,135,911
Iron and steel wire rods	......	313,341	407,513	511,951

The production of pig iron reduced to tons of 2,240 lbs is 9,202,703, which is an increase of 21 per cent. over the total for 1889, and 41 per cent. more than in 1888. The production of Bessemer-steel ingots last year was very much the largest in the history of the American steel trade, being 3,688,871 gross tons of 2,240 lbs., or nearly 26 per cent. greater than the total for 1889. The output of Bessemer steel rails last year was 1,867,837 gross tons, which was an increase of 23 per cent. over 1889. The American production of open-hearth steel is still very far below the English, although it amounted to 513,232 gross tons, which was 37 per cent. over the total for 1889. It is of interest to note, in connection with Southern developments, that of basic steel there were produced 62,173 net tons, almost wholly by the open-hearth process. The production of crucible steel is set down at 79,716 net tons, or 71,175 gross tons, a decrease of about 6 per cent. as compared with the total for 1889.

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Phosphorus in Iron and Steel.—It is generally known that phosphorus is very objectionable in iron and steel, as it makes the iron cold short and the steel brittle. Now, in the manufacture of iron by the puddling process, the phosphorus is eliminated by *liquation* to a large degree, so that iron may be puddled even though it contain from ½ to 2 per cent. of phosphorus. But when M.. Henry Bessemer invented his process for making steel, he found that he could not eliminate the phosphorus because he made the steel in a liquid state, and a liquid cannot be liquated under such conditions, therefore he required iron ores for his process that would not leave more than one-tenth of one per cent. of phosphorus in the resulting steel, and this demand made the Bessemer iron ores of a high-priced class.

A few days since a gentleman came into my office, and said that he had a mountain of the best and purest iron ore in Texas, ever known, and showed me a statement that charcoal pig metal could be made at that point from this ore at a cost of $10 per ton. He said that the analysis showed that it was very low in phosphorus. I replied that I was sorry to hear that the phosphorus was so low, for the iron in his ton of pig metal was only worth three-quarters of a cent a pound, while the phosphorus that was in it was worth 10 cents per pound, more than 13 times as much as the iron. And, although he was pretty well posted in general, he was astonished to hear that we are now in a quiet way making about 1,000 tons of steel per week; this steel contains 67 lbs. of phosphorus in each ton, which is 67,000 lbs. I then oxidize this phosphorus to P_2O_5 by adding the following amount of oxygen, 86,128 lbs.; thus producing phosphoric acid, 153,128 lbs. We then add fresh lime, 612,512 lbs.; which gives us phosphate of lime, 765,640 lbs. We then grind this phosphate and bag it and sell it as odorless phosphate; the price is one cent per pound by the bag, $18 per ton in less than car loads, and $15 per ton in 100 ton lots. The sales will average about $16 per ton at the works. Now, 765,640 lbs. at $16, gives us $6,124.12 per week for the phosphate that we make in extracting the phosphorus out of 1,000 tons of metal.

This phosphate is a new chemical compound, never known until I produced it by the practice of the basic process. It proves to be the quickest and finest plant food ever used, and is now in great demand for fertilizing the orange groves of Florida. It makes the oranges to ripen quicker, and makes them heavier with luscious juices than ever known before. It is also in demand by the grape growers, for they have found that the stinking phosphates, when used on grape vines, give the grapes a flavor not their own, and as the odorless phosphate which I produce from the steel is as odorless as wood ashes and as healthy as a sunbeam, they use it on grape vines so as to secure a more delicate flavor in the grape. It is also now being used largely by the truck gardeners as a fertilizer for vegetables for table use. And people are now beginning to inquire, "are we not carrying bacteria to our tables, and thus swallowing disease germs with our food, when we eat vegetables fertilized with decaying matter."

I gave my Texas expert this and more than this, and he has gone back to Texas to hunt for a phosphoritic iron mine, so that, in dull times like these, he can make a handsome profit by giving the steel at cost, and selling the phosphate for a compensation, together with the satisfaction that he is making the richest, the cheapest and the finest plant food ever known, and warranted free from the deadly bacteria that are so often carried from the slaughter-house to the farm, and then to the graveyard.—Jacob Reese in *Iron Trade Review.*

◆

The Outlook for the Iron and Steel Trade.

American Manufacturer.

The outlook for the iron and steel trade for the near future is by no means a cheerless one. But that the trade should be better and the outlook more promising, will be generally conceded. An analysis of the conditions as they exist and the causes which have brought these about will not be out of place.

At the time of the beginning of the strike in the Connellsville coke region early in February last, and the voluntary shut down of the furnaces in the Mahoning and Shenango valleys, which had taken place in January, it was confidently expected and predicted in the trade that if the strike mentioned proved of long duration, an improvement in prices would take place owing to the scarcity of pig iron, which would result from the shutting down of so many furnaces. But this has not taken place. Of the furnaces in blast in Western Pennsylvania and the Mahoning Valley of Ohio on January 1st, excluding one stack running on spiegel, the weekly production was 50,301 tons; in the same territory, February 1st, 36,575 tons; March 1st, 28,897 tons; and on April 1st it had diminished to 25,187 tons. From these figures it will be seen that for the past three months the production of pig iron in this district has been steadily and rapidly decreasing until to-day it is barely fifty per cent. of what it was at the beginning of the year, yet there has not been a great reduction of stocks, only about 50 per cent.; prices are lower and there is less activity in the trade, and that too at a time when in the natural course of things there should be a good demand for pig iron for manufacture into structural material and supplies.

Noting these facts the question arises, why is there not a better demand for structural material, which would induce a demand for pig iron. We believe the present eight-hour agitation in the building trades is in a large measure responsible for the depression which exists, and until this is definitely settled we do not believe any marked improvement in the iron and steel trade can be looked for. Added to this fact too is another, and that is that there is a comparatively small amount of new railroad building projected for this season, and this of course has its effect upon the steel rail and structural material business.

It is noticeable in this city, and scarcely less so in others, according to reports received, that little new work is being done, and builders stand aloof from making any contracts on account of the uncertainty as to the cost of labor for the coming season. Instances can be pointed out where work has already been begun, but has been suspended pending the settlement of the question of how mony hours shall constitute a day's work. A large quantity of other work, which under ordinary circumstances would have been carried out, is being at least delayed, if not indefinitely postponed, pending a settlement of this matter. The absence of this demand from the ordinary volume of business has made itself felt severely in the iron and steel market, in the want of "tone," which a lack of inquiries is sure to induce, if for no other reason.

If the present agitation continues, and especially if a

Mail Contract.

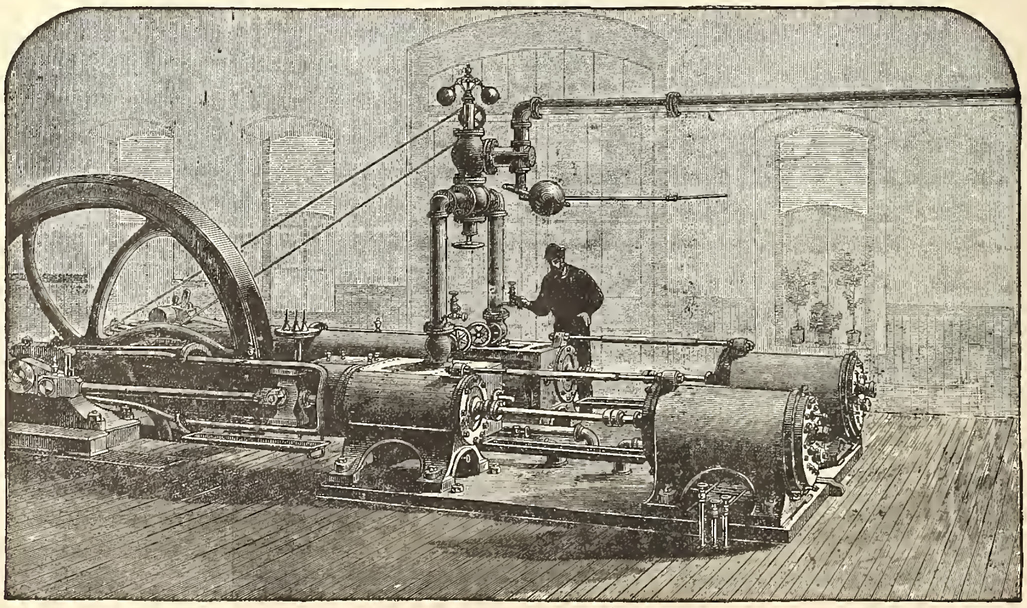
SEALED TENDERS, addressed to the Postmaster General, will be received at Ottawa until noon, on Friday, 15th May, 1891, for the conveyance of Her Majesty's Mails, on a proposed Contract for four years, six times per week each way, between Winchester and Osgoode Station P.O., from the first June next.

The conveyance to be made in a suitable vehicle via the Post Offices at Ormond, Vernon, Dalweny, West Osgoode and Osgoode Station, and also via the residence of Mrs. John Ferguson, Lot 21, Con. 6, Tp. of Osgoode, three times per week, in the event of a Post Office being established at that point.

Printed notices containing further information as to conditions of proposed contract may be seen and blank forms of Tender may be obtained at the Post Offices of Ormond, Vernon, Dalweny, West Osgoode, Osgoode Station and Winchester, and at this office.

F. HAWKEN,
P.O. Inspector.
Post Office Inspector's Office,
Ottawa, 8th April, 1891.

THE CANADIAN RAND DRILL COMPANY,
SHERBROOKE, QUE.



THE ABOVE CUT illustrates our DUPLEX AIR COMPRESSOR, which in the United States has become the Standard Machine for permanent plants where economy of fuel is sought.

We also build Straight Line Compressors—the best of their class—for Contractors' use and for Exploration work where low first cost and semi-portability outweigh considerations of economy of fuel.

All our Compressors are now fitted with our positive-motion Air-Valves, the only real improvement that has ever been made over the old Spring Valves.

general strike for an eight-hour day in the building trades takes place, as now seems almost inevitable, the iron and steel trade cannot escape being seriously crippled throughout the whole season. For building operations which consume such a large tonnage of the output of our mills will be either so late in opening. and so many will be held over until next season that the demand for material will be necessarily small in comparison with what it usually is.

It is perhaps well that this agitation, if come it must, come throughout all the trades at once. And when its settlement is effected it may be for all of them. For the past few years the trades have been in a constant state of agitation over the question of hours and wages and union and non-union matters. One has been no sooner settled than another has come up to act as a disturbing element. It cannot be said that, so far as a real settlement of the matter is concerned, what has been done amounts to any more than a skirmish as compared with a well defined campaign. A little has been gained here and there, but no settlement can be said to have been arrived at. About all that has been done is the keeping of all parties concerned in a state of uncertainty and uneasiness so far as the general course of business is concerned.

If a campaign is at hand, it is probable that both sides are as well prepared for it as they ever will be. In the iron and steel industry the conservatism which has characterized operations during the past six or eight months more than at any recent preceding period, has put manufacturers in a position to bear the burden as well as they ever can, and better than at almost any time in the past. And the labor leaders claim to have their organizations so perfected and of such strength that concerted effort can be made.

Western Minerals.

MR. W. HAMILTON MERRITT will be in Western Canada in July and August, and will undertake the examination of mineral properties in Western Ontario, Manitoba, the North-West Territories or British Columbia.

Address 15 TORONTO STREET,
TORONTO.

Acid Waters! Acid Waters!!

IMPERIAL BOILER COMPOUND CO.

TORONTO,

Have produced a compound that will NEUTRALIZE either SULPHURIC ACID or other acids in the water to be used in steam boilers. It is, of course, known that these acid waters do not make scale, but cause the boiler to be "pitted" with small holes, and render it almost useless in about six months.

The remedy now offered has been wanting for years, and will be a great boon for steam users whose supply of water has to be taken from these acid streams. We sell it under a GUARANTEE OF SUCCESS.

Send five gallons of the water in carboy to be analysed. Also state size of boiler and hours running a day.

IMPERIAL CHEMICAL CO.,
Soho Machine Works, - Toronto.

STAMPS!

PRITCHARD & ANDREWS,
173 & 175 SPARKS STREET.

GENERAL ENGRAVERS,
Rubber Stamp Manufacturers,
SCALE MAKERS AND BRASS WORKERS.

Brands, Steel Stamps, Time Checks and Tags.
Stencils and Ink, Scales and Weights.

RUBBER STAMPS FOR OFFICE WORK.

EBEN E. OLCOTT,
CONSULTING MINING ENGINEER.
Cable Address: Kramolena, New York.

Examinations Made
AND
Reports Rendered on Mines and Mineral Properties,
Metallurgical Works and Processes.

Will act as permanent or special advising engineer of mining companies.

Represents Mr. M. P. Boss, of San Francisco, and his system of continuous milling for the amalgamation of gold and silver ores.

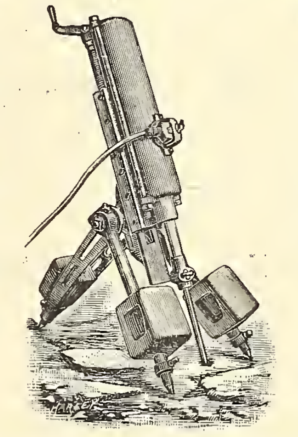
EDISON GENERAL ELECTRIC COMPANY.
EDISON BUILDING, BROAD STREET, NEW YORK.

TEST OF ELECTRIC PERCUSSION DRILL.

A recent test at Quincy, Mass., of one size of our Electric Percussion Drill showed it to be far superior to Steam or Compressed Air Drills.

In the exceptionally hard Quincy Granite, a hole 1.5 inches in diameter was drilled at the rate of 2.75 inches per minute, with but 3 1-2 Horse-Power used at the driving-belt of Generator.

Drill was taken entirely apart and put together again in 10 minutes.



Declared by Experts Present "THE IDEAL DRILL."

FOR PRICES AND INFORMATION ADDRESS NEAREST DISTRICT OFFICE.

Canadian District, Bank of Commerce Building Toronto, Can.
Central District, Rialto Building, Chicago, Ill.
Eastern District, Edison Building, Broad Street, New York.
New England District, 25 Otis Street, Boston, Mass.
Pacific Coast District, 112 Bush Street, San Francisco, Cal.
Pacific Northwest District, Fleishner Building, Portland, Ore.
Rocky Mountain District, Masonic Building, Denver, Col.
Southern District, Gould Building, 10 Decatur Street, Atlanta, Ga.

EASTERN DEVELOPMENT COMPANY, LIMITED.

Organized under Special Act of the Legislature of Nova Scotia.

OWNERS OF THE COXHEATH COPPER MINES AND LITTLE RIVER COAL MINES IN CAPE BRETON, N.S.

THE ONLY DEVELOPED COPPER MINE IN THE WORLD of proved large value, located practically at tide water and beside coking coal—consequently sure to become a cheap producer.

$1,000,000 OF 20 YEAR 7 PER CENT. GOLD BONDS. Interest payable in May and November at the office of the AMERICAN LOAN AND TRUST COMPANY BOSTON, MASS.

$350,000 of bonds already sold and devoted to purchase and development of the properties. $350,000 additional now offered at par and accrued interest from May 1st, 1891, with 50 shares of stock as bonus with each $1,000 bond. Proceeds to build concentration and smelting plant. Remaining $300,000 of bonds reserved for future increase of capacity.

BOARD OF MANAGEMENT.

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Main Office of the Company—95 MILK STREET, Boston, Mass. *Prospectus Mailed on Application.*

SUDBURY NICKEL LANDS

FOR SALE

A FIRST-CLASS INVESTMENT.

Several very valuable locations containing rich deposits of Nickel and Copper Ore, situate in the Townships of Moncrieff and Craig, in the Sudbury Mining District, Province of Ontario.

Mr. J. R. Gordon, C.E., who spent most of the season of 1890 investigating the nickel deposits in the vicinity of Straight Lake, a station on the main line of the Canadian Pacific Railway, about 47 miles west of Sudbury, reports very favorably of these properties. The deposits extend from about one mile north-east of the railway to about four miles southwest. Where the lode crosses the track in the Township of Moncrieff, the vein or deposit of nickel is nearly 20 feet wide. The vein varies in width from 10 to 20 feet, but in places is over 30 feet wide. At the western terminus of the lode in the Township of Craig, which is immediately west of the Township of Moncrieff, the width increases.

The Huronian rocks have been traced by Dr. Robert Bell, of the Geological Survey of Canada, for a distance of some three miles west of the Spanish River, and to South and West are gneiss formations.

In his paper published in the bulletin of the Geological Society of America, Dr. Bell describes this district "The Geneva Lake Outlier."

Plans, Experts' reports, and full particulars may be had by addressing

J. M. CLARK,
27 Wellington Street East, Toronto.
OR
W. A. CLARK,
Agent Dominion Express Co., Ottawa.

Competent Mine Foreman Wanted

For the Eastern Townships. A thoroughly competent underground foreman. Must be capable of pushing rock work rapidly (drifts, slope shafts and back stopes) and timbering. Address, stating experience, and giving references and salary required, RAST, Canadian Mining and Mechanical Review, Ottawa.

FOR SALE.

The following first-class Phosphate lands in Templeton, P.Q:

West ½ of Lot	8, 10th	Con.,	100 acres.
South ½ "	16, 10th	"	100 "
"	11, 12th	"	215 "
"	12, 12th	"	190 "
South pt. "	13, 12th	"	50 "
North " "	21, 12th	"	147 "
"	11, 13th	"	161 "
"	12, 13th	"	132 "
"	17, 13th	"	47 "
			1142 acres.

These lands are held in absolute fee simple under Crown Patents. In addition to phosphate they contain many other minerals, among which may be mentioned ASBESTOS, MICA and BARYTES. As will be observed, most of the lots are in fairly close proximity, and they adjoin, or are actually traversed by a good county road, affording easy transit to the East Templeton Railway Station and Wharves on the Ottawa River. After personal examination Sir William Dawson, LL.D., F.R.S., F.G.S., the eminent Geologist, reported regarding this property: "In my opinion it has been very judiciously selected both with reference to probable yield of phosphate and facility of transport."

Application may be made to

Mr. L. Marcellais,
Perkins' P.O.,
East Templeton, P.Q.

Or to **Mr. A. T. Paterson,**
Box 2002, Montreal.

TO USERS OF THE DIAMOND DRILL.

Diamond Drill Bits set Promptly by an Efficient Man. All Work Guaranteed.

Bort and Carbon Diamonds for sale. Same terms as New York. Prospecting with American Diamond Drill at per foot or by the day.

McRae & Co.,
OTTAWA.

JUDICIAL SALE

OF A

MINERAL LOCATION in the District of Thunder Bay, Ontario, Canada.

Pursuant to the order of the Chancery Division of the High Court of Justice for Ontario, there will be sold by public auction with the approbation of the Master in Ordinary, by Wm. H. Hewson, Auctioneer, at the Northern Hotel in the Town of Port Arthur, on Monday, the 6th day of July, 1891, at 12 o'clock, noon, the following lands and premises: The Mineral Location known as Block "A" on Current River, in the Township of McIntyre in the said district of Thunder Bay, containing by admeasurement 400 acres more or less.

The above property is situated on Thunder Bay, at the head of Lake Superior, and is within three miles of the Town of Port Arthur.

There is water power on the property, the Current River running through the centre of the lot.

For further particulars and terms of sale apply to,

BRUCE, BURTON & BRUCE,
Barristers,
May 16th, 1891. Hamilton, Ont.

STANDARD POWDER COMPANY.

MANUFACTURERS OF ALL KINDS OF

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FOR

MINING AND RAILROAD WORK.

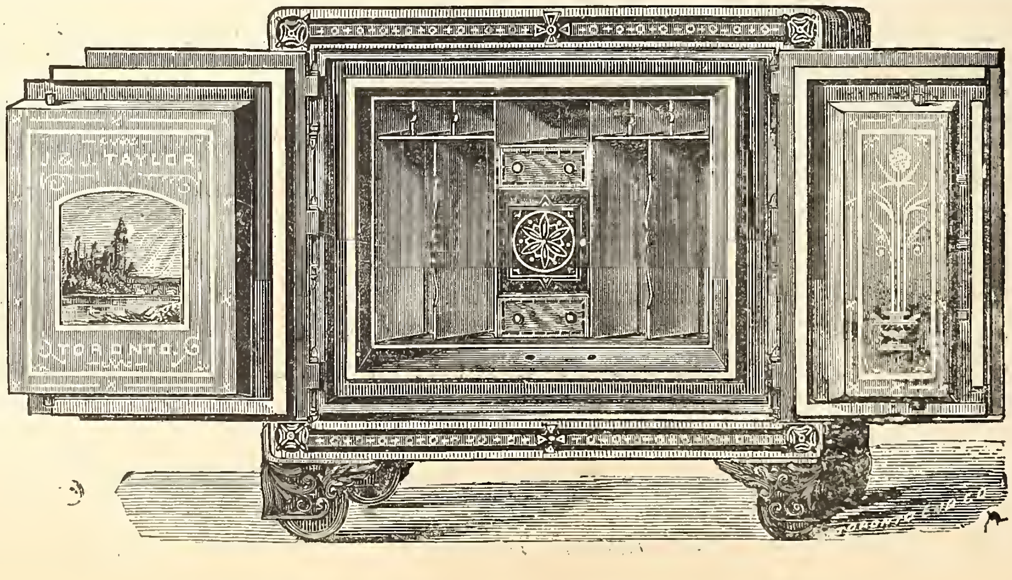
ADDRESS **W. H. HARRISON,**
Manager,
Brockville, Ont.

FOR SALE.

J. & J. Taylor,

ESTABLISHED 1855.

Toronto Safe Works.



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Fire and Burglar Proof Safes.

Second-Hand Safes

Constantly in Stock at Low Prices.

Catalogues and Prices on Application.

TENDERS.

SEALED TENDERS marked "For Mounted Police Provisions and Light Supplies," and addressed to the Honourable the Minister of Railways and Canals, Ottawa, will be received up to noon on Friday, 19th June, 1891.

Printed forms of tender, containing full information as to the articles and approximate quantities required, may be had on application at any of the Mounted Police Posts in the North-West, or at the office of the undersigned.

No tender will be received unless made on such printed forms.

The lowest or any tender not necessarily accepted.

Each tender must be accompanied by an accepted Canadian bank cheque for an amount equal to ten per cent. of the total value of the articles tendered for, which will be forfeited if the party declines to enter into a contract when called upon to do so, or if he fails to complete the service contracted for. If the tender be not accepted the cheque will be returned.

No payment will be made to newspapers inserting this advertisement without authority having been first obtained.

FRED. WHITE,
Comptroller N.W.M. Police.

Ottawa, May 15th, 1891.

Chemical and Assay Apparatus.

AGENTS FOR THE DOMINION FOR THE

MORGAN CRUCIBLE COMPANY, BATTERSEA, ENGLAND,

AND FOR THE

Analytical and Assay **Balances & Weights of Beckers Sons, Rotterdam.**

Microscopes of E. Leitz, Wetzlar. Kavalier's Bohemian Glassware. Royal Berlin and Meissen Porcelain. Platinum Wire, Foil, Crucibles and Dishes. Swedish Filter Paper. Chemically Pure Reagents and Volumetric Solutions.

An Illustrated Priced Catalogue on Application.

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BATTERSEA ROUND.

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9 Cliff St., New York.

Engineers, Metallurgists & Assayers.

Public Ore Sampling and Storage Works

All the principal buyers of furnace materials in the world purchase and pay cash against our certificates of assay, through New York banks.

By special permission of the Secretary of the Treasury of the United States, cars of ore or Copper matte passing through in bond can be opened and sampled at our works.

Consignments received and sold to highes. bidder. Send for circular giving full particularst

Mines examined and sampled. Assays and Analyses of all kinds.

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EIMER & AMEND,

Importers and Manufacturers of

CHEMICALS, CHEMICAL APPARATUS,

AND

Assay Goods,

205, 207, 209 & 211 Third Avenue,

NEW YORK.

SPECIALTIES:

BALANCES, WEIGHTS, PLATINUM.

Absolutely Pure Chemicals and Acids, Royal Berlin and Meissen Porcelain, Kavalier's Bohemian Glass.

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Best Goods, Low Prices, Prompt Shipment, Careful Packing.

RICHARDS & COMPANY,

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Agents for BECKERS SONS' Balances and Weights of Precision, of Rotterdam, Holland.

Morgan Crucible Co.,

BATTERSEA, ENGLAND,

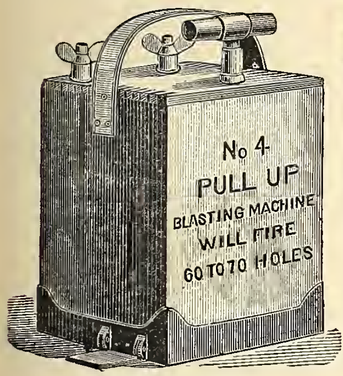
Manufacturers of

Crucibles, Furnaces, Muffles, AND SCORIFIERS

Of Superior Quality.

LEONARD RICHARDS, Agent,
41 Barclay St., New York.

BATTERSEA ROUND.



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VICTOR ELECTRIC FUSE

VICTOR ELECTRIC PLATINUM FUSES.

Superior to all others for exploding any make of dynamite or blasting powder. Each fuse folded separately and packed in neat paper boxes of 50 each. All tested and warranted. Single and double strength, with any length of wires.

VICTOR BLASTING MACHINE.

Made in two sizes. No. 2 fires 20 to 30 holes. No. 1 fires 5 to 8 holes. Adapted for prospecting, stump blasting, quarry and general railroad work.

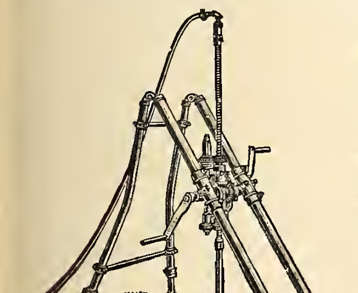
"PULL-UP" BLASTING MACHINE.

The strongest and most powerful machine ever made for Electric Blasting. No. 4 size fires 70 holes. No. 3 size fires 40 holes. Are especially adapted for submarine blasting and large mining works.

Standard Electric Fuse and Blast Tester, Wire Reels, new design. Leading and Connecting Wire.

Manufactured only by **JAMES MACBETH & CO.,**

128 MAIDEN LANE, NEW YORK CITY.



"M" Drill--Hand Power.

Capacity—300 ft. depth.

Removes 1$\frac{3}{16}$ inches solid core.

DIAMOND DRILLS
FOR
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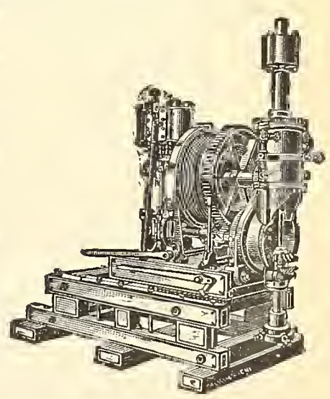

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Ontario Mining Laws.

The following is a summary of the chief provisions of the amendments to the Mining Laws of Ontario, passed during the Session of 1891 :

1. In Algoma, Thunder Bay, Rainy River and that part of Nipissing north of Lake Nipissing and the French and Mattawa Rivers, the price per acre of mining lands sold after the 4th day of May, 1891, is $4.50 in a surveyed township, and $4 in an unsurveyed territory, if within 12 miles of a railway, and if beyond that limit $3.50 in surveyed and $3 in unsurveyed territory. Elsewhere the price is $3 in a surveyed township any part of which lies within 12 miles of a railway, and $2 if at a greater distance.

2. Instead of by grant in fee simple, mining land may be obtained under a ten years' lease at a per acre rental, unless otherwise fixed by regulation, of $1 for the first year and 25 cents yearly thereafter if north of Lake Nipissing and the French and Mattawa Rivers, or of 60 cents for the first year and 15 cents yearly thereafter, if situated elsewhere, with right of renewal at the expiration for an additional ten years at the same rentals, and with a right of renewal thereafter every twenty years, subject to payment of the yearly rent charge in advance and to such conditions as may be provided by regulation. But the lessee may at any time purchase the land so held, in which case the first year's rent shall be treated as part of the purchase money.

3. The owner or lessee of mining land sold or leased by the Crown after the 4th day of May, 1891, is required during the first seven years to expend in actual mining operations $4 per acre if the location exceeds 160 acres, and $5 per acre if it is 160 acres or less.

4. After the 4th day of May, 1891, all ores or minerals of silver, nickel, or nickel and copper, taken from lands sold or leased by the Crown, are subject to a royalty of 3 per cent., and all other ores or minerals to such royalties as shall from time to time be fixed by Order-in-Council, not exceeding in the case of iron 2 per cent., and as to any other ores or minerals not exceeding 3 per cent.; and such royalties shall be calculated upon the value of the ores at the pit's mouth. But royalties shall not be imposed or collected upon any ores until after seven years from date of the patent or lease, except as to mines known to be rich in nickel, and as to these not until after four years.

5. Hereafter in all lands sold under the Public Lands Act, or for agricultural purposes, all minerals and mining rights are reserved to the Crown, unless otherwise provided in the patent or grant.

6. In the case of mining lands for which bona fide application was made in writing to the Department prior to the 24th April, 1891, grants may be made where the application is received within three months from the 4th day of May, 1891, and otherwise at the price and upon the conditions heretofore applicable in accordance with the terms of section 1, sub-section 5, of the Act of 1891.

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Licenses are issued to owners of quartz crushing mills who are required to pay Royalty on all the Gold they extract at the rate of two per cent. on smelted Gold valued at $19 an ounce, and in smelted gold valued at $18.00 an ounce.

Applications for Licenses or Leases are receivable at the office of the Commissioner of public Works and Mines each week day from 10 a.m. to 4 p.m., except Saturday, when the hours are from 10 to 1. Licenses are issued in the order of application according to priority. If a person discovers Gold in any part of the Province, he may stake out the boundaries of the areas he desires to obtain, and this gives him one week and twenty-four hours for every 15 miles from Halifax in which to make application at the Department for his ground.

MINES OTHER THAN GOLD AND SILVER.

Licenses to search for twelve months are issued, at a cost of twenty dollars, for minerals other than Gold and Silver, out of which one square mile can be selected for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

All rentals are refunded if afterwards the areas are worked and pay royalties. All titles, transfers, etc., of minerals are registered by the Mines Department free of charge, and provision is made for lessees and licensees whereby they can acquire promptly either by arrangement with the owner or by arbitration all land required for their mining works.

The Government as a security for the payment of royalties, makes the royalties first lien on the plant and fixtures of the mine.

The unusually generous conditions under which the Government of Nova Scotia grants its minerals have introduced many outside capitalists, who have always stated that the Mining laws of the Province were the best they had had experience of.

The royalties on the remaining minerals are : Copper, four cents on every unit ; Lead, two cents upon every unit ; Iron, five cents on every ton ; Tin and Precious Stones ; five per cent. ; Coal, 7½ cents on every ton sold.

The Gold district of the Province extends along its entire Atlantic coast, and varies in width from 10 to 40 miles, and embraces an area of over three thousand miles, and is traversed by good roads and accessible at all points by water. Coal is known in the Counties of Cumberland, Colchester, Pictou and Antigonish, and at numerous points in the Island of Cape Breton. The ores of Iron, Copper, etc., are met at numerous points, and are being rapidly secured by miners and investors.

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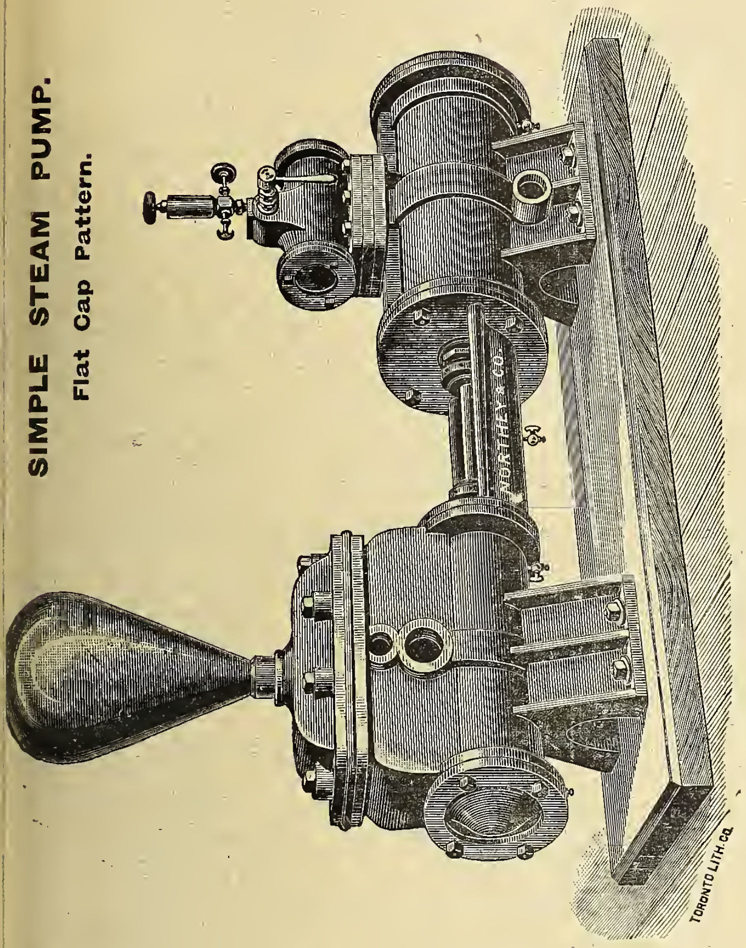
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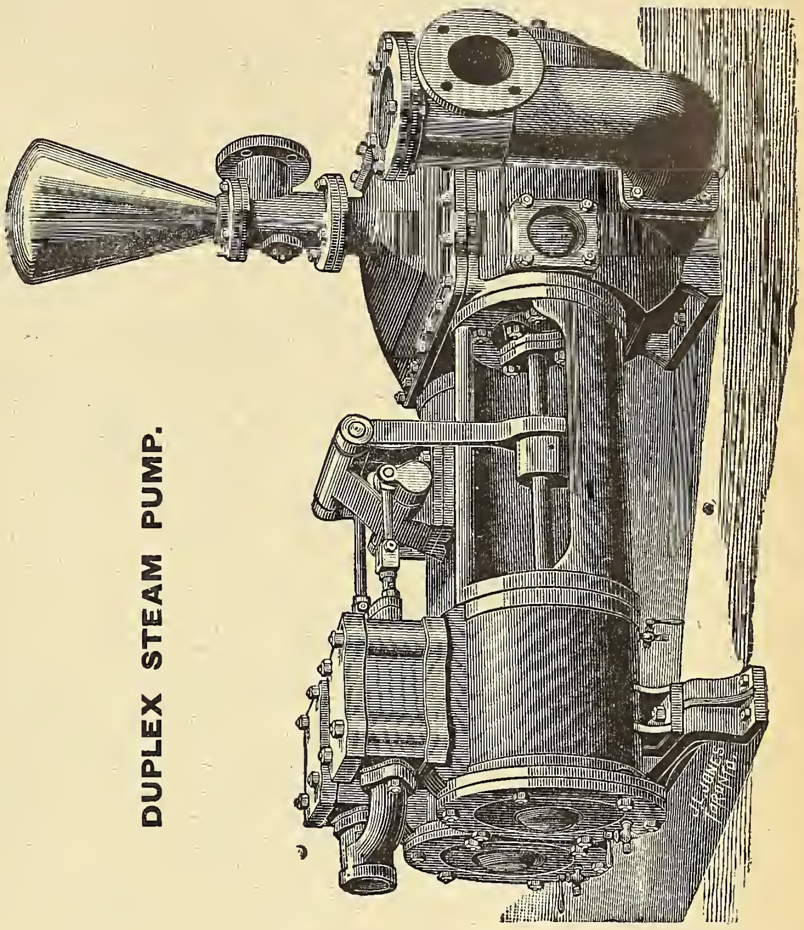

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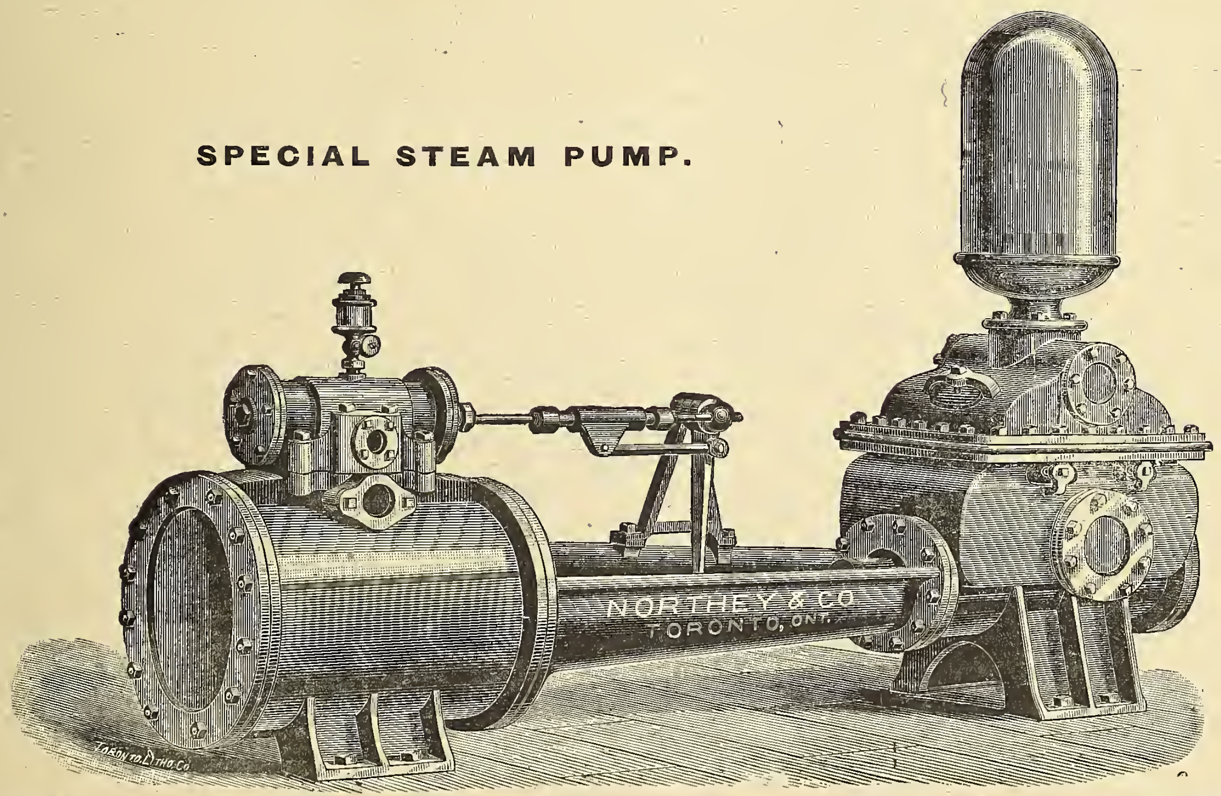
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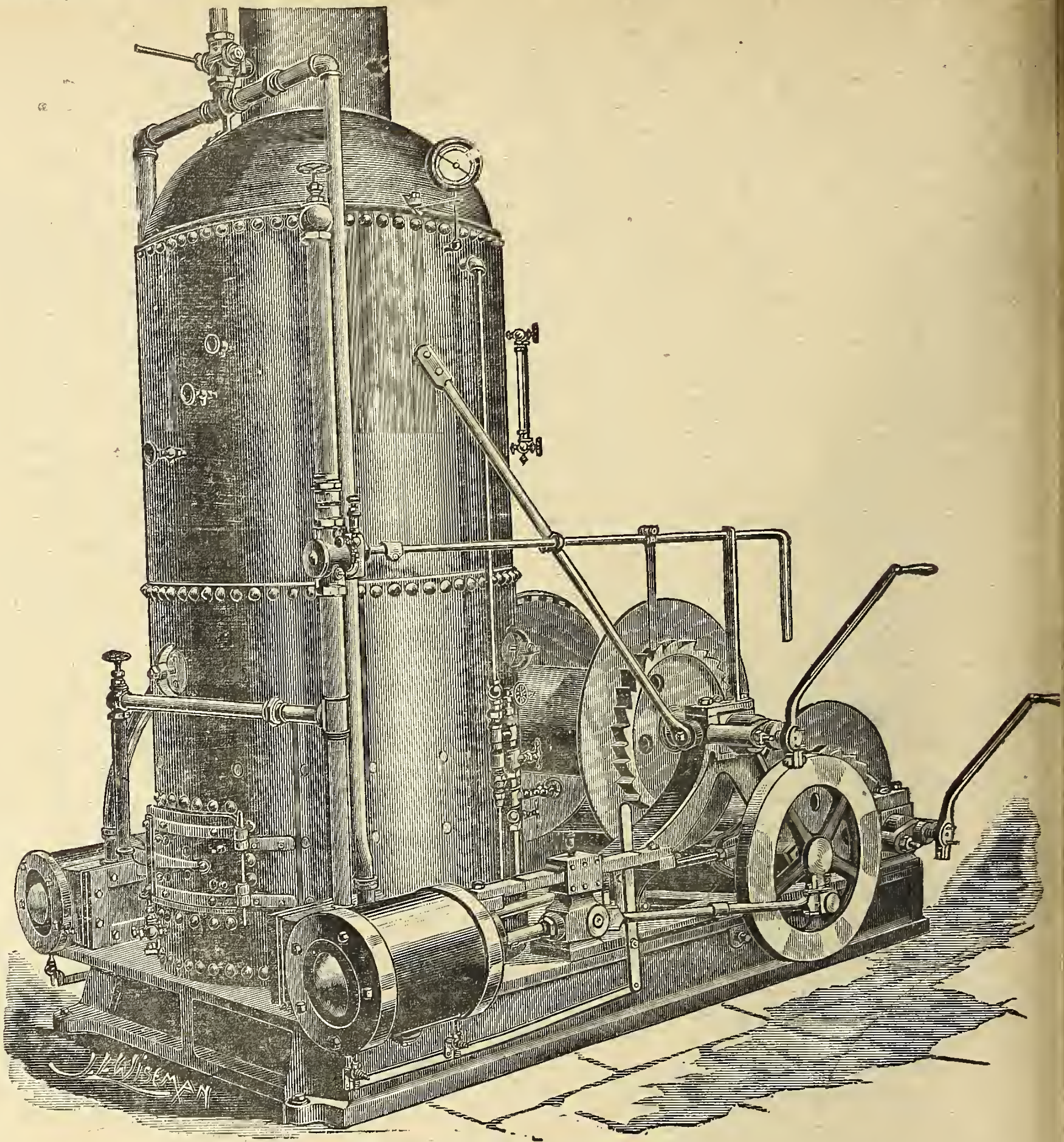

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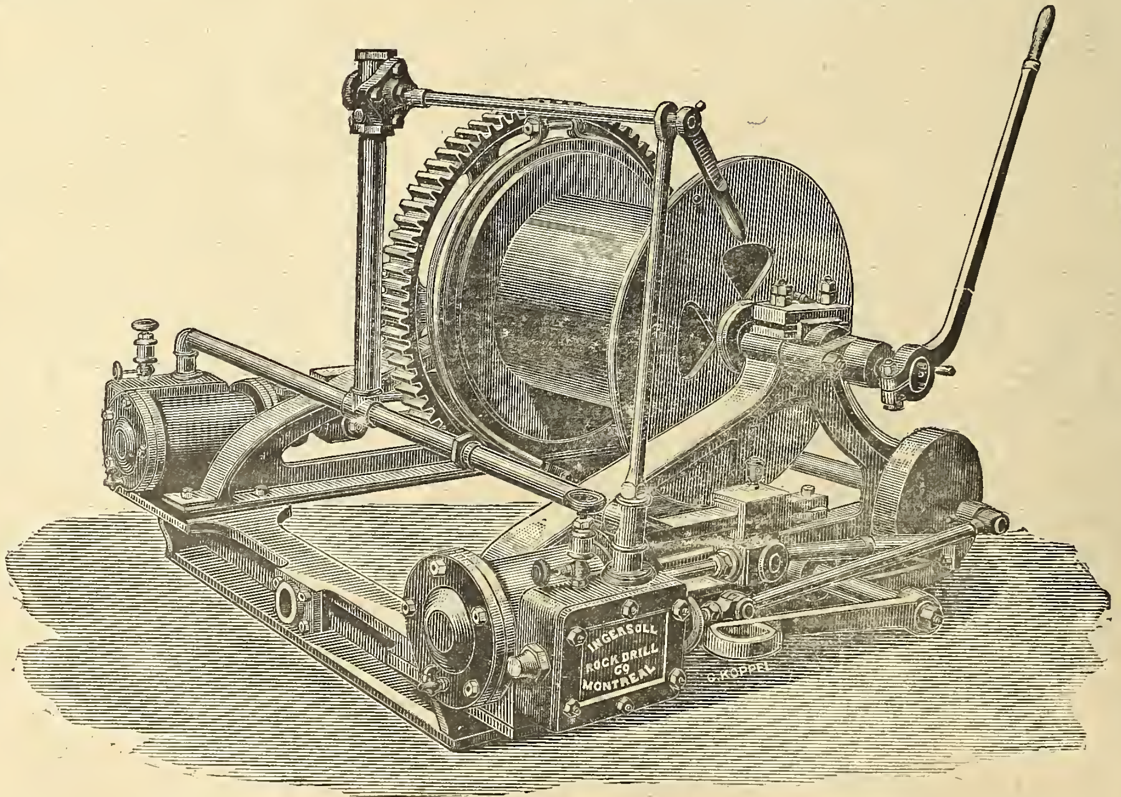

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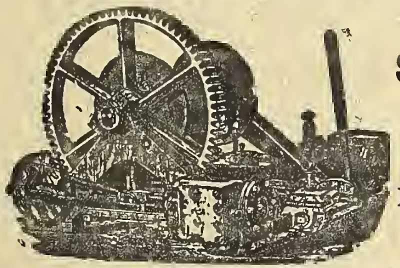

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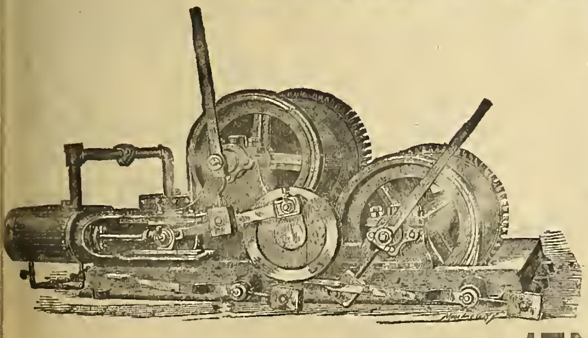

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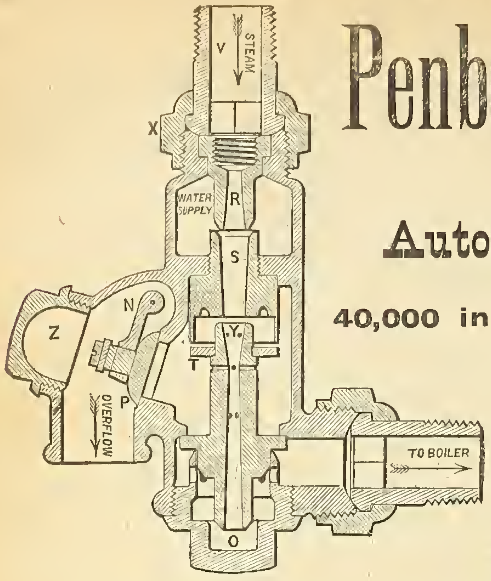

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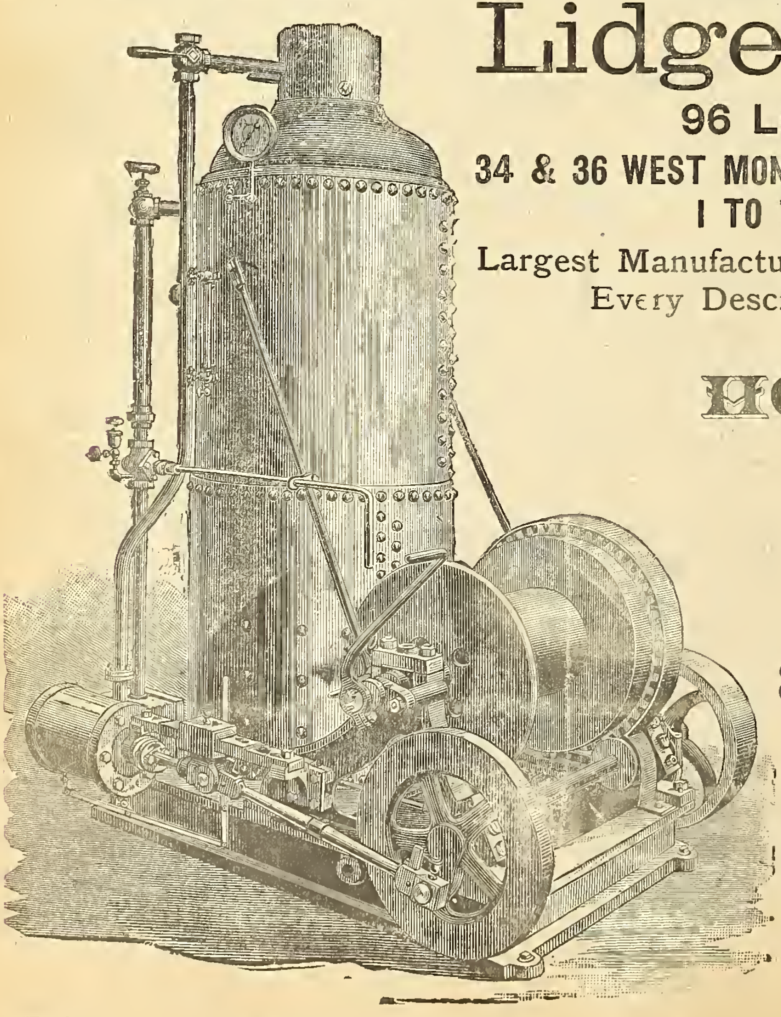

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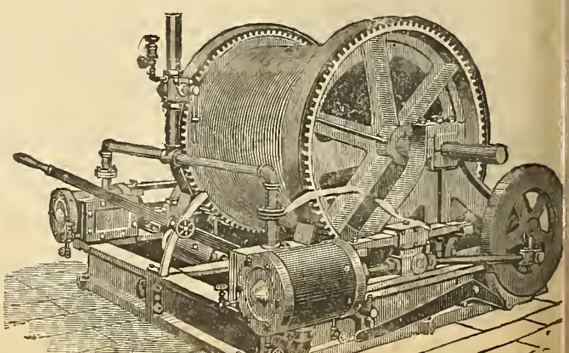

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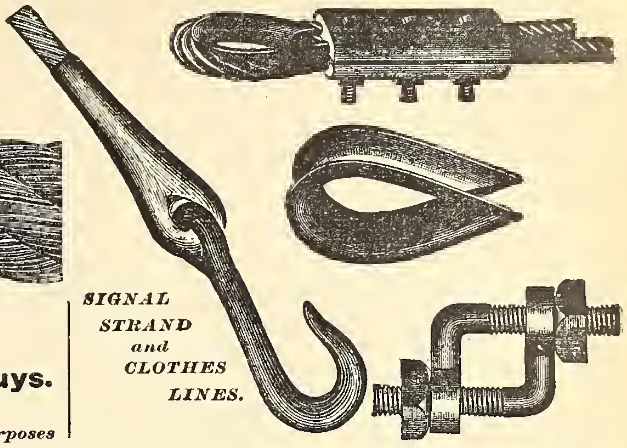

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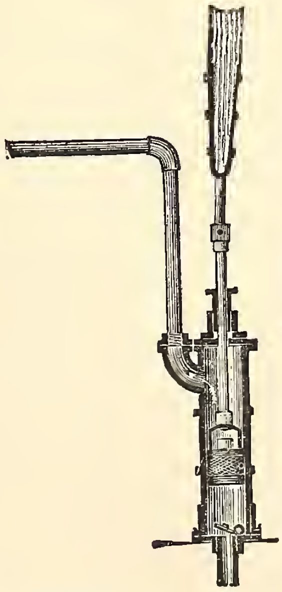

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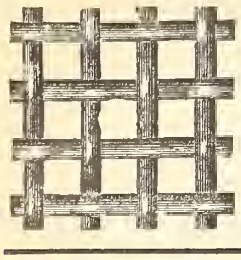

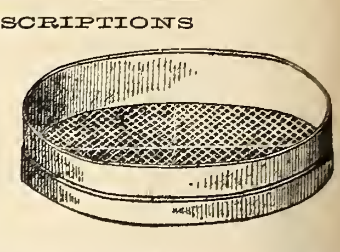

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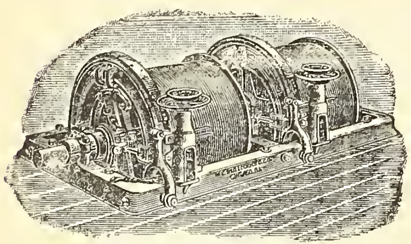

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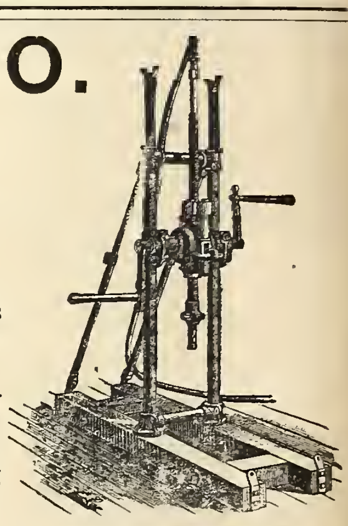

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" 3—10 to 20 " "

Size 4— 15 to 30 tons per hour.
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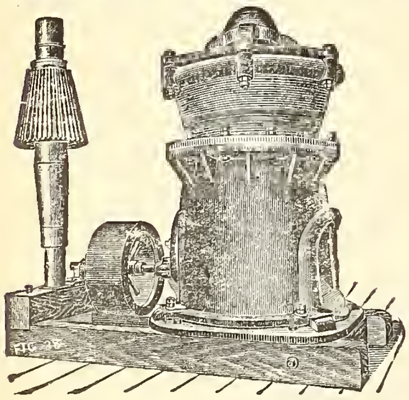

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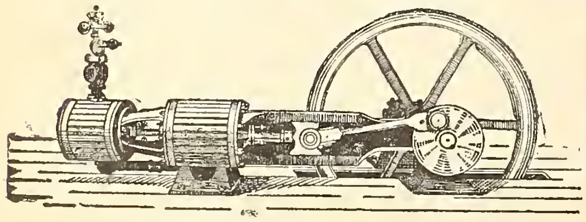

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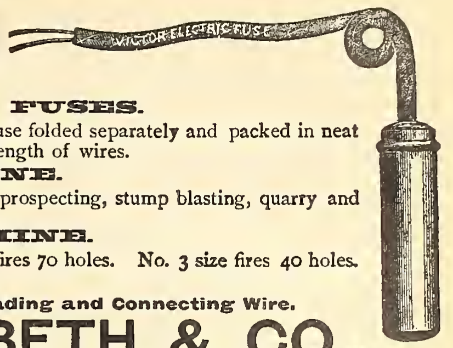

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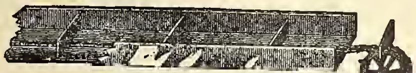

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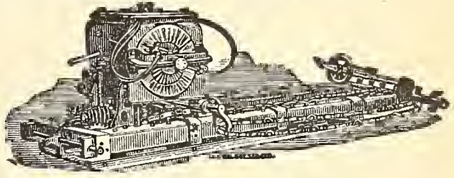

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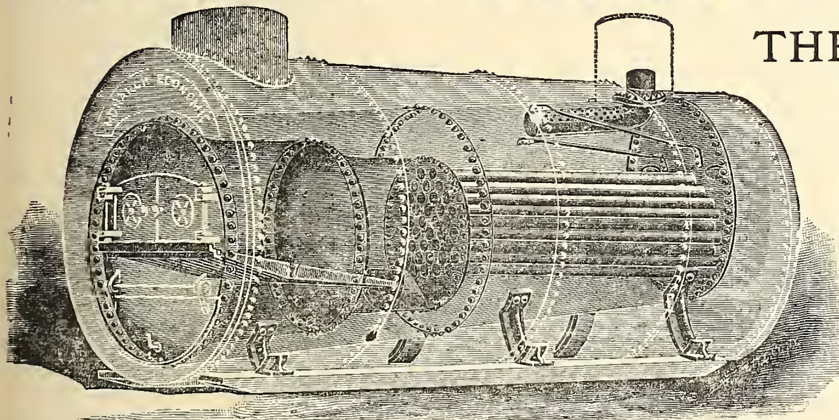

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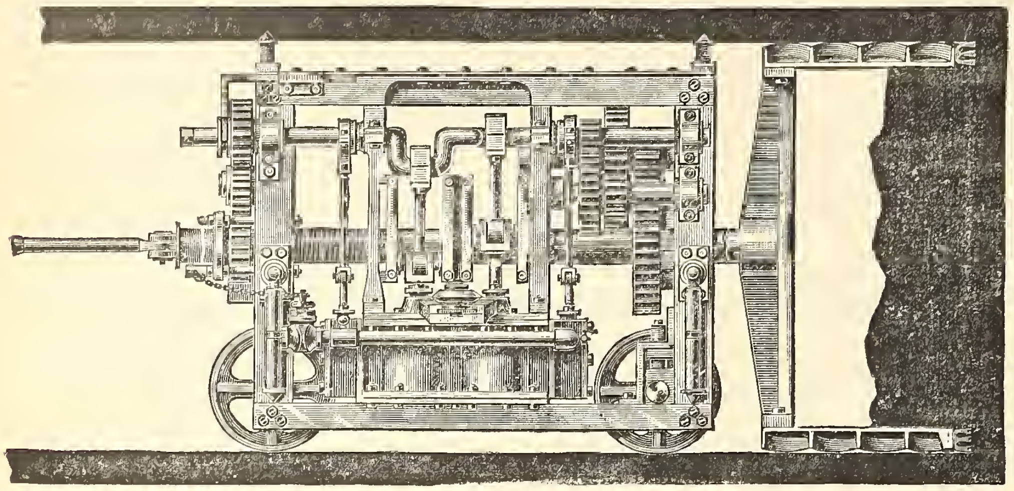

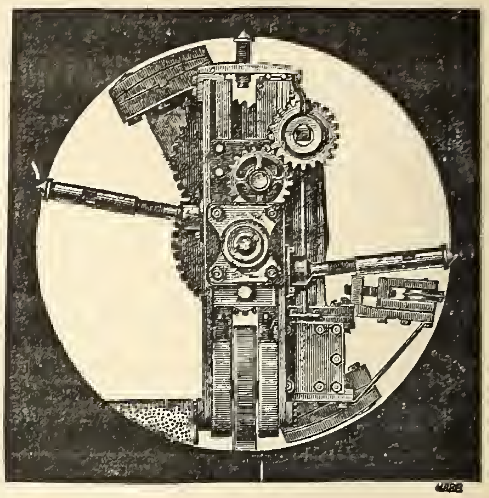

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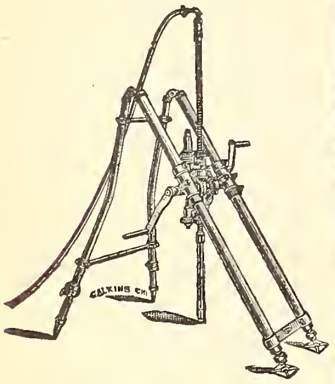

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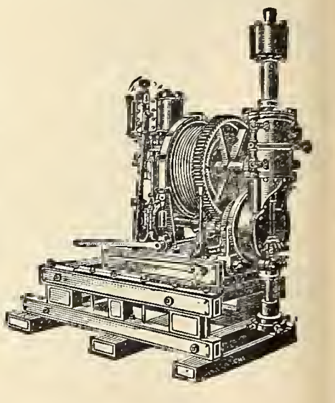

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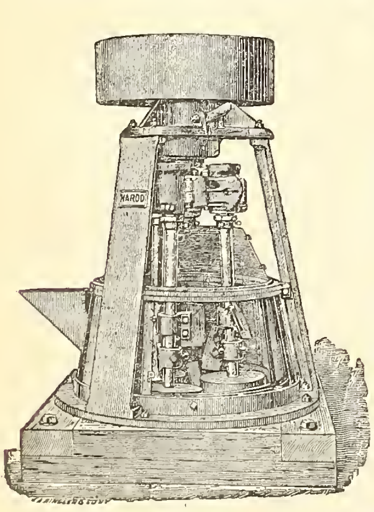

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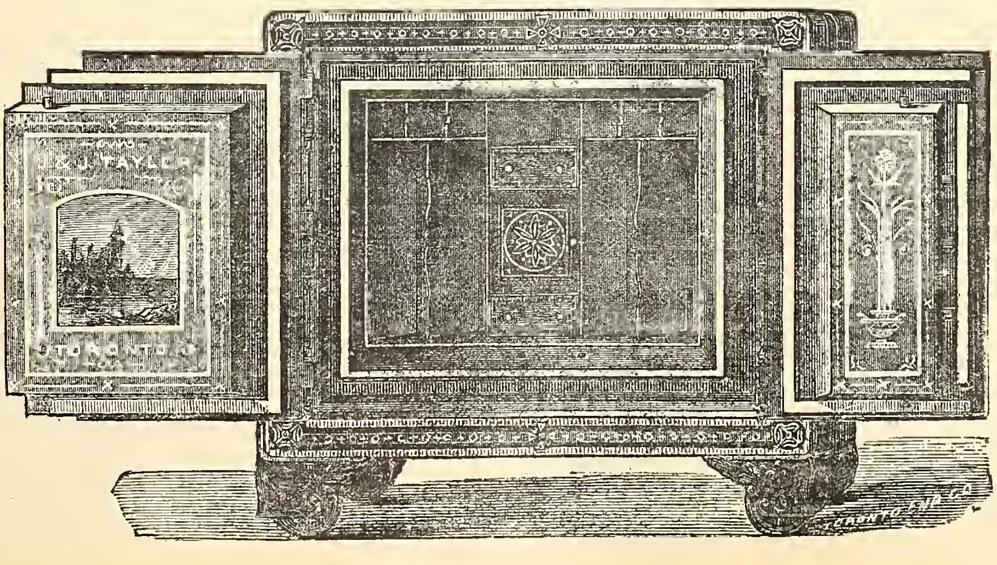

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Ontario Mining Laws.

The following is a summary of the chief provisions of the amendments to the Mining Laws of Ontario, passed during the Session of 1891 :

1. In Algoma, Thunder Bay, Rainy River and that part of Nipissing north of Lake Nipissing and the French and Mattawa Rivers, the price per acre of mining lands sold after the 4th day of May, 1891, is $4.50 in a surveyed township, and $4 in an unsurveyed territory, if within 12 miles of a railway, and if beyond that limit $3.50 in surveyed and $3 in unsurveyed territory. Elsewhere the price is $3 in a surveyed township any part of which lies within 12 miles of a railway, and $2 if at a greater distance.

2. Instead of by grant in fee simple, mining land may be obtained under a ten years' lease at a per acre rental, unless otherwise fixed by regulation, of $1 for the first year and 25 cents yearly thereafter if north of Lake Nipissing and the French and Mattawa Rivers, or of 60 cents for the first year and 15 cents yearly thereafter, if situated elsewhere, with right of renewal at the expiration for an additional ten years at the same rentals, and with a right of renewal thereafter every twenty years, subject to payment of the yearly rent charge in advance and to such conditions as may be provided by regulation. But the lessee may at any time purchase the land so held, in which case the first year's rent shall be treated as part of the purchase money.

3. The owner or lessee of mining land sold or leased by the Crown after the 4th day of May, 1891, is required during the first seven years to expend in actual mining operations $4 per acre if the location exceeds 160 acres, and $5 per acre if it is 160 acres or less.

4. After the 4th day of May, 1891, all ores or minerals of silver, nickel, or nickel and copper, taken from lands sold or leased by the Crown, are subject to a royalty of 3 per cent., and all other ores or minerals to such royalties as shall from time to time be fixed by Order-in-Council, not exceeding in the case of iron 2 per cent., and as to any other ores or minerals not exceeding 3 per cent.; and such royalties shall be calculated upon the value of the ores at the pit's mouth. But royalties shall not be imposed or collected upon any ores until after seven years from date of the patent or lease, except as to mines known to be rich in nickel, and as to these not until after four years.

5. Hereafter in all lands sold under the Public Lands Act, or for agricultural purposes, all minerals and mining rights are reserved to the Crown, unless otherwise provided in the patent or grant.

6. In the case of mining lands for which bona fide application was made in writing to the Department prior to the 24th April, 1891, grants may be made where the application is received within three months from the 4th day of May, 1891, and otherwise at the price and upon the conditions heretofore applicable in accordance with the terms of section 1, sub-section 5, of the Act of 1891.

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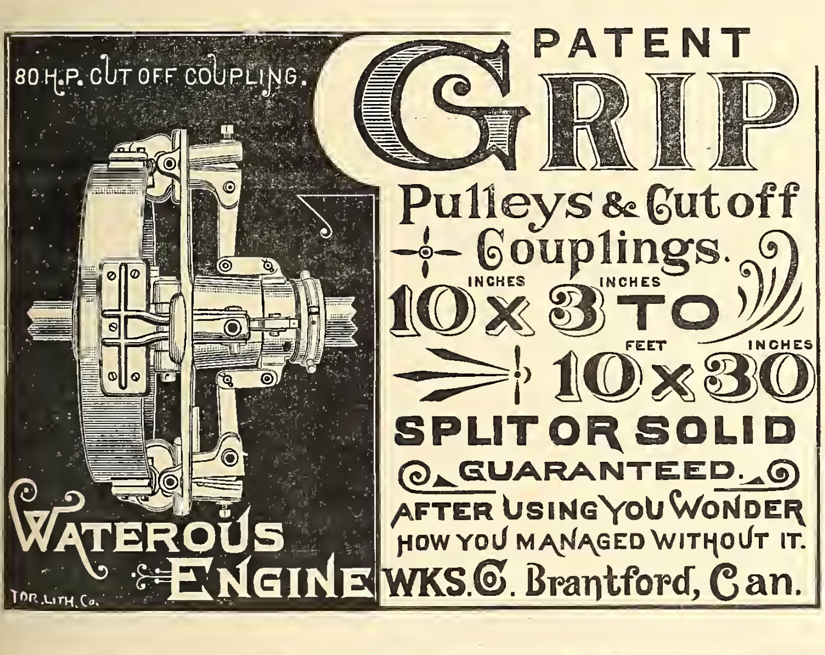
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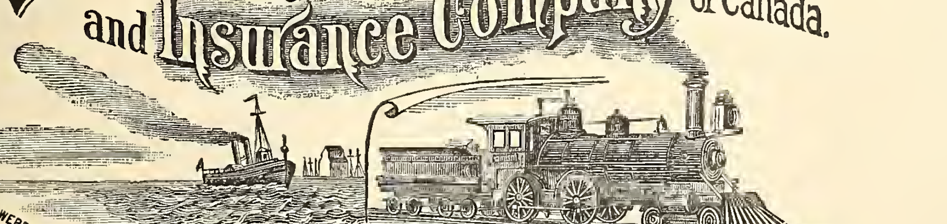

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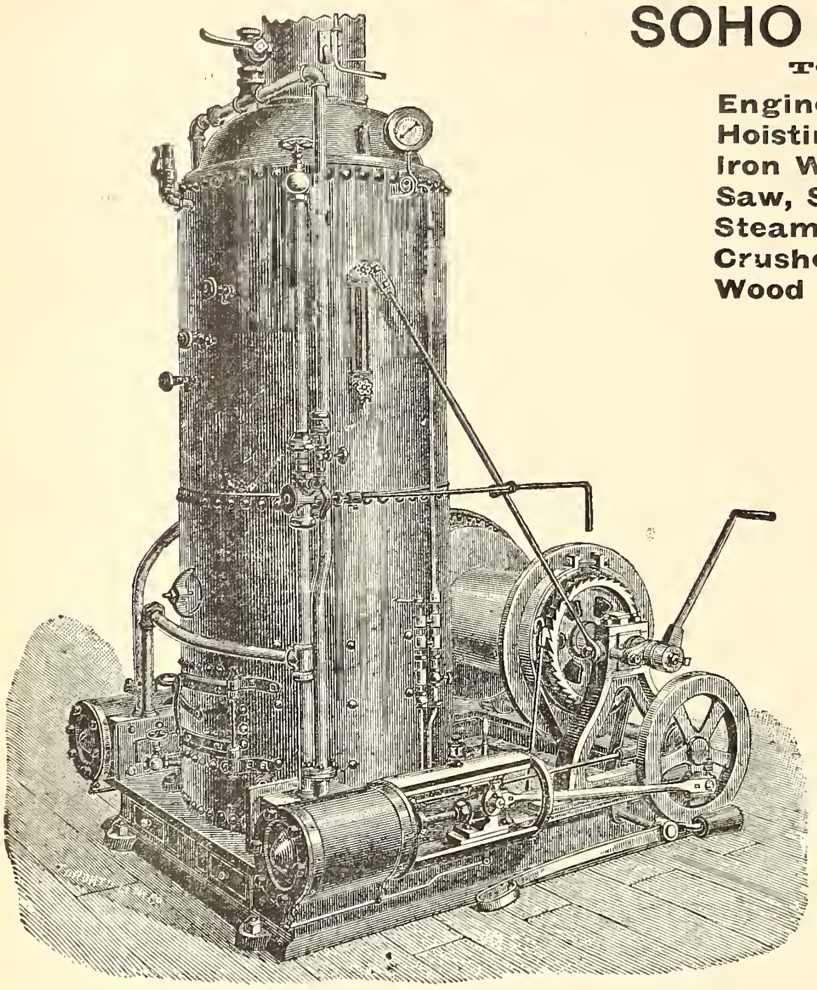

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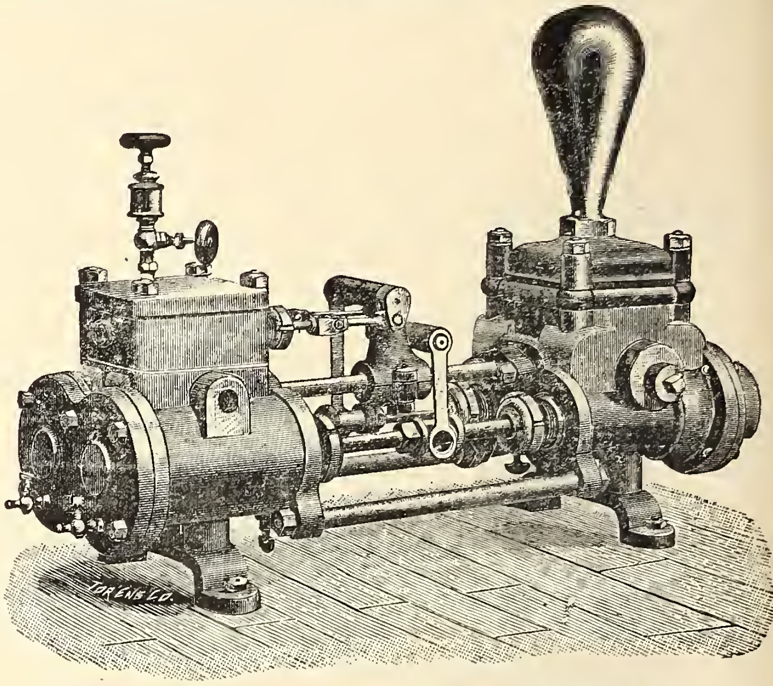

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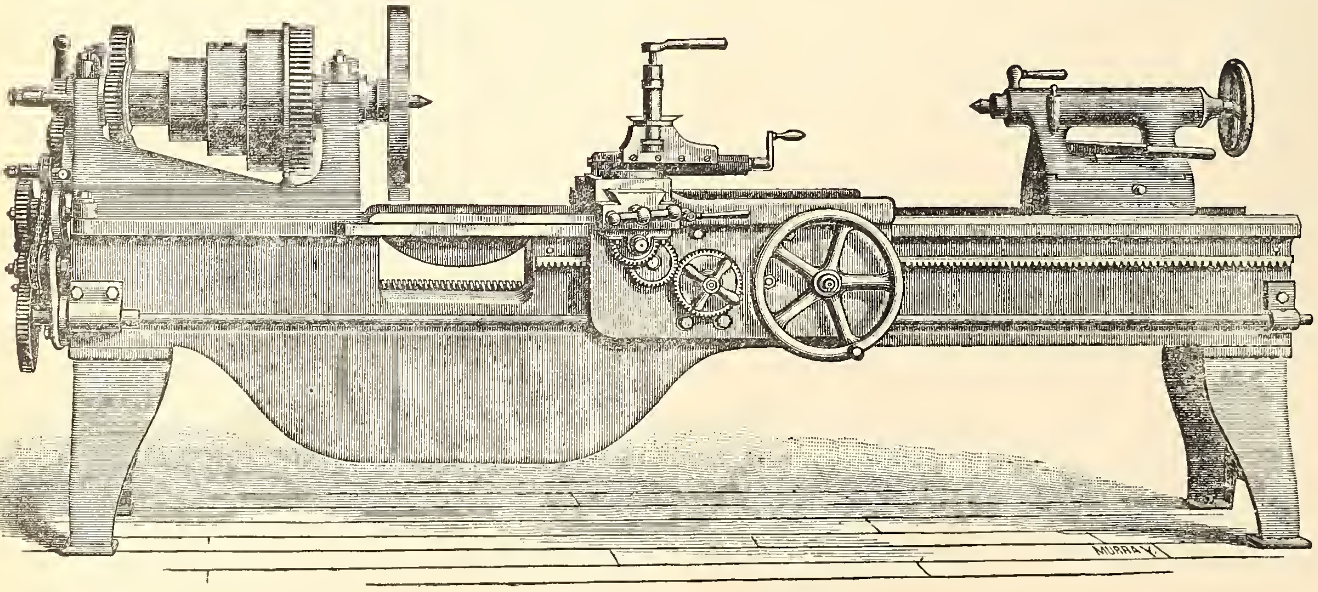

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Licenses to search for twelve months are issued, at a cost of twenty dollars, for minerals other than Gold and Silver, out of which one square mile can be selected for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

All rentals are refunded if afterwards the areas are worked and pay royalties. All titles, transfers, etc., of minerals are registered by the Mines Department free of charge, and provision is made for lessees and licensees whereby they can acquire promptly either by arrangement with the owner or by arbitration all land required for their mining works.

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The royalties on the remaining minerals are : Copper, four cents on every unit ; Lead, two cents upon every unit ; Iron, five cents on every ton ; Tin and Precious Stones ; five per cent. ; Coal, 7½ cents on every ton sold.

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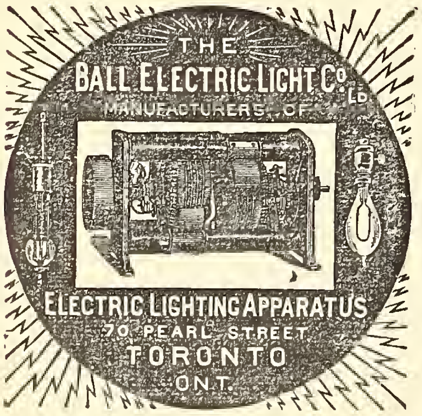

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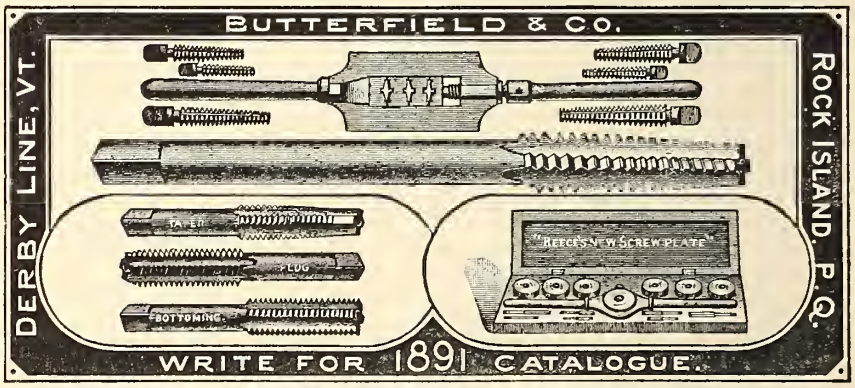
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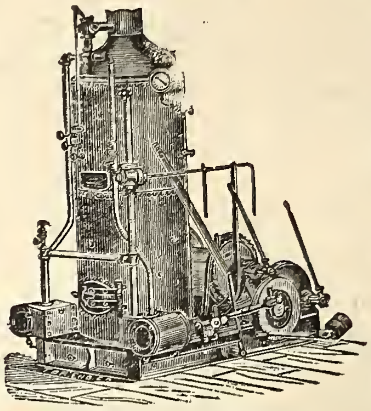

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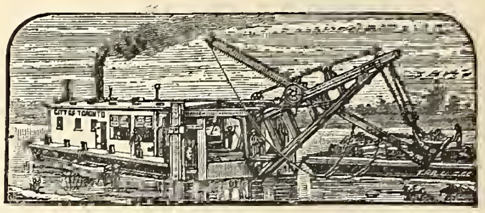

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CANADIAN MINING & MECHANICAL REVIEW

CONDUCTED BY - - - - - - B. T. A. BELL.

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Applied Science at McGill University.

The announcement of McGill University for next session gives evidence that the governors fully understand that the advance of applied science calls for additions to the teaching staff and increased laboratory equipment, and are prepared to meet the demand to the utmost of their ability. Industrial chemistry, metallurgy, electrical science, and the constructive arts daily enter upon the occupation of new fields, and are daily fruitful in new problems. Canadian graduates must successfully grapple with these problems or give place to men who are fitted for such tasks by the education provided by other communities. The importation of many millions of dollars worth of metals every year, for the manufacture of which this country possesses ores and fuel in abundance, may be viewed as a political problem from different standpoints, but it offers only one practical question to the instructed manufacturer, for the solution of which he is dependent upon the revelations of the chemist and the devices of the engineer. The laboratory is an indispensable adjunct to every metallurgical works, and its operator must acquire his training in the class-rooms and laboratories of the modern school of applied science An institution of this sort, with well-equipped laboratories for physical and chemical demonstration, and the foundation of a professorship of electrical engineering, have been given to McGill University by Mr. W. C. McDonald. Large gains for Canadian mining enterprise may be hoped to follow Mr. McDonald's wise gift. Electrical science has but recently given much aid to miners by the incandescent light and the transmission of motive power to points difficult of access. Still more recently we have the concentration of lean iron ores and the depuration of rich ores from phosphorus by the magnetic separator. In fact the more or less successful operation of 26 concentrating mills in the United States raise some expectation that this preparation of ore for the furnace may prevent the basic process for purifying steel from obtaining a place in American manufacture. Be this as it may, it is beyond doubt that the value of lean ores has been immensely increased and the purification of rich ores from phosphorus made practicable by a process which had its first application in the invention of Dr. LaRue of Quebec, for depurating the iron sands of the Lower St. Lawrence.

Mr. McDonald's munificent gift has evidently been prompted as much, if not more, by a hearty love of scientific research as by a spirit of generosity; for he has provided for students desiring to engage in original research a special laboratory.

Of the other laboratories it is worthy of note that the hydraulic presents special features in the motive power of a 200 feet head of water afforded by the Montreal Water Works, and in the equipment with various turbines and water-wheels. The applications of hydraulic pressure touch many arts, such as the manufacture of the finest brick, the compression of steel ingots, the operation of cranes of enormous power. The mountain streamlet, though slender in volume, if it be only of high fall, when married to a dynamo sends its energy along a wire to some remote peak and lights the miner's pathway, works his drill and lifts his ore to the mouth of the shaft. The immense power of our own mighty rivers is second to none in the world in capacity for aid to industrial enterprise. These considerations indicate somewhat the great value of the aid offered to students of engineering by the hydraulic laboratory of the McGill University.

If in the equipment of the cement-testing laboratory we may discern the recognition of the value of Canadian cements and the importance of testing their efficiency, as well as of guarding the engineer from the many worthless cements put on the market, the remark may be permitted that the addition of a small milling plant and muffle and would enable students to do serviceable work in the preparation of cements. Synthesis as well as analysis should have its place in experimental enquiry. Recent discoveries point to our rock silicates as materials for cements deserving of investigation, and this remark leads up to the suggestion that the firing of Siemens' furnaces with Lima oil and super-heated steam instead of with coal, now in successful operation at Bethlehem, Pa., presents to the Faculty of McGill University means of providing for metallurgical research a small manageable furnace of great efficiency, easily constructed, occupying little space, and maintainable at moderate cost. There are some knotty points in thermo-dynamics which the use of this oil and water-gas fuel presents, and if to these were added the problems presented by the greatest steam-generator of the day, the Babcock & Wilcox boiler, the students of McGill who would be brought to the study of these questions might make while going through their curriculum very profitable use of the instruction the thermo-dynamic laboratory is otherwise so well fitted to impart.

The workshops on the endowment of Thomas Workman, are fully equipped for practical instruction under the professor of Practical Engineering. A special lecturer or professor will, next year, undertake the course of lectures on mining and metallurgy. The university requires aid for this purpose, and it is intimated that funds are necessary to place the Mining School on a secure basis. A permanent endowment of $2,000 is asked for, and the REVIEW hopes it may be doubled for the purpose of intimating to the governors that the public need demands that McGill University, otherwise so well equipped to instruct in every auxiliary science, shall take a foremost place in teaching metallurgical science. It is stated that no special mining laboratory has yet been provided for instruction in practical ore-dressing. This want should be supplied ere another session and nothing left undone to equip with all methods of practical research this great Canadian institution of learning.

Bush Fires.—A More Stringent Application of the Law Demanded.

The recent destruction of the Asbestos Club House, along with other valuable property at Black Lake, reminds us of the urgent necessity that exists for some more stringent application of the law respecting bush fires which will diminish, if not altogether eliminate this constant and harassing menace to the miner in various of our mining camps. Until quite recently no organized effort was made in the Province of Quebec to prevent the annual recurrence of these bush-fires — indeed the Crown Lands Department seemed to be animated by an insane desire to destroy every trace of verdure on the hills, leaving nothing but the rocks. Not only were lands which were totally unfit for settlement disposed of to ignorant pioneers, attracted to such remote places by the timber and the fishing rather than the quality of the soil, but purchasers were bound under pain of forfeiture of their homes and improvements, to destroy a certain percentage of the timber upon their lands before being granted their patents. Recently a disposition has been manifested to check this criminal waste of a rapidly diminishing source of revenue, but so far with little practical effect. In the sale of mining lands, for instance, the government reserves the right to the timber for three years. During that time the lumberman who owns the limit in which the lands are situate, has the privilege of removing such timber as he may want. Very frequently this timber would be of considerable value to the miner in the construction of his works and buildings, but having no direct interest in the timber, and having every interest in learning the character of the rocks beneath his first step after taking possession is usually to start a forest fire to burn the moss, forest growth and debris from the rocks. But with them goes valuable timber. Unfortunately it is seldom limited to the locality of its origin, but, as in the instances before us, it extends into neighbouring properties, sweeping large areas of timber, and destroying much valuable property. We hope that the Commissioner of Crown Lands will see to it that his large retinue of so-called "Mining Inspectors" are given full instructions to look closely into this matter, and that the law will be made stringent enough to suppress the evil altogether.

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The subject of our next portrait sketch will be Dr. George M. Dawson, Assistant Director of the Geological Survey of Canada.

To Our Readers.

In May, 1886, when the Review was assumed by its present management, it consisted of eight pages of reading matter and four of advertisements, twelve in all, with a circulation of 431 copies; in May, 1891, it had increased to fifty pages, twenty-nine being reading matter and twenty-one advertisements, with a circulation of *four thousand* copies. The wide distribution of our last issue, not only throughout the various provinces of Canada, but among capitalists and others interested in Canadian mining in different parts of the world, may be gathered from the following authentic returns taken from our books:—

	Copies.
Province of Ontario	1,338
" Quebec	624
" Nova Scotia	748
" New Brunswick	72
" British Columbia	273
Province of Manitoba and N. W. T.	28
United States	564
Great Britain	207
France	57
Germany	53
South America	18
British West Indies	5
Australia	5
South Africa	2
Japan	5
Italy	1
Total circulation for May	4,000

Any 'doubting Thomases' who may be disposed to question the veracity of these figures, are invited to examine our mailing sheets for themselves, when they will be thoroughly convinced of the truth of these statements.

◆

We notice that the *Trades Journal* and several other Nova Scotian papers have been complaining of the noxious fumes produced by the explosive roburite. On what slight grounds they do so may be judged from the report of a committee appointed by the Durham Coal Owners' Association and the Durham Miner's Association, to investigate the question, which found: That the products of the explosion of roburite and tonite are not more deleterious than those of gunpowder; that no chemical evidence was obtained of the presence of nitro-benzine, and throughout the enquiry no case of nitro-benzine poisoning was met with; that with regard to the production from roburite, tonite and gunpowder of carbon-monoxide, the quantity found in average samples taken is small, and is so quickly dissipated by the air current as to have been detected only in traces, five minutes after the firing of the shot. It was recommended that an interval of five minutes be allowed to elapse after the firing of a shot before the hewers be allowed to re-enter the place, and also that cartridges be fired by electricity, owing to the umes given off by the burning fuse.

EN PASSANT.

We are indebted to the *Colliery Engineer* Co. of Scranton, Pa., for a copy of their valuable little hand-book, the "Colliery Engineer Pocket Book." It is replete with information on every point connected with the subject and will be of great assistance, especially, to miners who are preparing themselves to take a certificate; we cordially recommend it to their notice.

Elsewhere in our columns will be found an excellent article on "The Nickel and Copper Deposits of Sudbury," from the pen of Mr. Alfred E. Barlow, M.A., of the Geological Survey. Mr. Barlow has been for several years engaged in the exploration of this region, associated with Dr. Robert Bell, and there is, perhaps, no one better qualified to deal with the subject, both from a scientific and practical standpoint, than himself.

The next quarterly meeting of the General Mining Association of the Province of Quebec, will partake of a holiday nature—a trip to the phosphate region being contemplated by the Council. A steamer will be engaged to carry the members and their friends up the Lievres as far probably as High Falls; here they will camp out for a couple of days, which, if the weather prove propitious, will be a pleasant change from the customary routine of similar excursions. Trips to the various mines in the vicinity will be arranged, and everything be done to make the visit serve a practical purpose, while maintaining the character of an outing.

Among the curiosities that occasionally crop out among the reports of mining companies, is that of a great French company which was to perform wonders in the gold fields of the Transvaal. Ten crushing mills produced in twelve days 300 oz. of gold, while in the preceding thirty days only 600 oz. were obtained, from which the shareholders are led to infer that the company is making very rapid strides in the direction of big dividends. In order to facilitate this desirable result the company has resolved to procure thirty more mills, ten of which have been already bought. It is expected that by means of these "the monthly yield of 56,000 francs will be very rapidly doubled." Their ideas on the subject of plant are certainly not limited by any notions of economy.

The following communication from Mr. H. P. McIntosh, Secretary of the Canadian Copper Company, will be of interest, as showing that this company has found mining in Sudbury to be profitable:—

To the Editor of the Canadian Mining Review:

Sir,—If it is sufficiently interesting, you might announce that this company has purchased about thirteen acres of land, on the Valley Railway, near Brooklyn Station, O., on which it will immediately erect a copper-nickel alloy plant.

Yours truly,
The Canadian Copper Co.,
By H. P. McIntosh, Sec.-Treas.

Cleveland, O., June 2nd, 1891.

It is understood that the works will be in operation by August. We trust that the result of their enterprise will be such as to induce some Canadian companies to follow their example on *this side* of the line.

On another page will be found some interesting communications from Mr. H. S. Poole, General Manager of the Acadia Coal Company, and Mr. T. Shaw, M.E., of Philadelphia, respecting the latter's gas testing machine, together with copies of a unique correspondence between Mr. Poole and Mr. Wilson. The dispute on Mr. Shaw's side is waxing acrimonious, and the Review comes in for a share of his withering sarcasm. Ordinarily, we believe him to be moderate and equable in his views, but on the subject of his pet instrument he becomes rampant and unmanageable, and ready to assail any and all who do not profess entire belief in its almost supernatural powers. We are quite willing to admit some of its virtues, but must decline to agree to its infallibility when the contrary has been proved. Our editorial tester was applied to the letter under consideration and showed a very large percentage of "gas," which Mr. Shaw with a workshop full of his machines was unable to perceive. But Mr. Shaw contrives, though perhaps with difficulty, to keep within the bounds of courtesy, which is more than can be said of his agent, J. R. Wilson. In his case impudence rises to a height almost sublime, and certainly unique. Under the guise of friendship, and with a patronizing verbosity not often equalled by other members of the "patent cure-all" fraternity, he undertook to read a lesson to his correspondent on the error of his ways, ignorantly imagining that by professing to see a danger which none but he could cure—a very stale trick of the Ancient Order of Quacks—he might contrive to sell his "universal panacea" of a machine. The culminating point was reached in his letter of March 16, when he asks: "Would you live to regret, like Cowans, that you were ever a mine superintendent?" which for gross impudence and heartlessness stands unrivalled. The Shaw machine, as we have said, undoubtedly has some merits, but if these are to be hidden under a bushel of wordy insolence, it will be difficult to dispose of at any price, far less five hundred dollars.

The Pictou *Journal* indulges itself in a long and laborious criticism of the letter from "Manager," which appeared in the April issue of the Review. Intended to be mildly sarcastic, it falls decidedly short of this expectation, being only inane in some parts and in others rather rude. It is not our province to defend our correspondent—we suspect, in any case, that he is more than able to hold his own in a discussion with the *Jonrnal*—but exception must be taken to certain remarks in respect to Nova Scotian colliery managers as a class. Commenting on their conduct in general, after a diatribe on those of a past generation, their surliness and vulgarity, it goes on to say: "They—the managers—have improved wonderfully of recent years, and if they continue as they have begun, it will not be a matter of surprise that they act like gentlemen, but the wonder will be that it was possible for them ever to have acted otherwise." This is most uncalled for, and is a gross libel on these gentlemen. By what standard the *Journal* judges them it is hard to conceive ; Chesterfield himself would hardly come up to it, and this paragraph alone would preclude the idea that even the most outrageous egotism could allow our contemporary to have any personal reference. It seems, however, that this captious critic, having no arguments to advance, adopted the cuttlefish or skunk mode of retreat as the safest, and having ejected a cloud of inky dirt, retired, leaving his opponents with a vague sense of having been in contact with something nasty.

We observe that a certain Rev. Mr. Pringle, of Port Arthur, having left the consideration of things spiritual for those temporal and of the earth earthy, has been airing his opinions, or what he believes to be such, on the new Ontario Mining laws. We suspect, however, that the worthy parson, with a simple faith characteristic of his kind, has been imbibing too freely of the doctrines propounded by some wily speculator in his flock—though mayhap there might be some thought of the acquisition of certain glebe-lands, rich in minerals, the development of which might materially advance the interests of a "Society for the Distribution of Top-boots and Neck-ties among the Cannibals." The clauses that especially appeal to his sympathies —or pocket—are those relating to the increase in the price of mining lands and the imposition of a royalty. "Fortunes," according to Mr. Pringle, "have been made by booming mineral lands in the Port Arthur-Sudbury sections, but fortunes have also been lost by men who have paid inflated prices for mining property." Exactly! But the proportion of fortunes made to those lost is so very small that it was a wise step to put an end to "booming," and substitute practical for speculative mining. With lands at $1 an acre there were far too many instances of speculators buying up large areas, and holding them at enormous and ridiculous prices, but they will not be so ready to do so now, when their hands have to dip so much deeper into their pockets. As for the plea that poor men will be unable to buy lands that they have prospected, we cannot see that their condition is altered to any appreciable extent ; capital can always be obtained to assist in a legitimate enterprise, and to capital they must go to develop a property, whether the price be $3 or 50 cents an acre. Without sharing in Mr. Pringle's exalted notions as to the preliminary outlay in mining operations, "the making of roads and *streets*," etc., the cost is certainly beyond the means of the ordinary prospector in any case. Thus the wisdom of the Government's policy is evident, tending as it does to eliminate the speculative element, without bearing unduly hard upon the poorer classes of miners. As for the royalty clause, the church is proverbially behind the times in secular affairs, and the holy miner is strictly in keeping with the tradition, his opinion being based upon the situation of affairs two months ago, since when they have radically changed. Altogether we should imagine that this worthy apostle of mis-information has quite enough on his hands in looking after the spiritual welfare of his lambs—who, by-the-by, as outside capitalists have not infrequently found to their cost, are much more liable to fleece than to be fleeced.

The first annual report of Mr. A. Slaght, Inspector of mines for the Province of Ontario, has been received, and we must confess, is an agreeable surprise. It is concise yet sufficiently voluminous to afford a very fair idea of the extent and nature of the mining operations carried on in the Province, and is well written and tastefully gotten up.

The last occasion upon which the late lamented Premier of the Dominion came in touch with mining matters was only a couple of months ago, just after the Springhill disaster. He was one of the first to respond to the appeal for help, and in one of the collection books now in possession of the REVIEW, stands his signature, thus :—

John A Macdonald $10.

We notice that the number of "remarkable discoveries" of minerals throughout the length and breadth of the land keeps fairly up to the average. The gentlemen who find these extraordinary deposits seem to be of a venturous nature as a rule, and blessed with a good luck that might make a fortune even on the Stock Exchange, for they appear invariably to come upon mineral, any sort that pays, in some inaccessible spot in the wilds, where no one ever supposed it to exist, and where verification of their reports is practically impossible. Their discoveries serve as baits, however, for the traps so continually laid for that gullible portion of the investing public, the "old maids and clergymen," who, by-the-by, keep coming forward in a steady stream that defies all the efforts of the company-promoters to exhaust. Anything out of the way, or that savors of the improbable, more especially if a remote possibility exists of distributing a few tracts among the "misguided Indian brethren" while working these colossal veins, is always snapped up if put before the right parties and in the right way. Some day these mistaken investors will learn that a moderate interest that you *do* get, is much better than a very large one that you *don't;* but in the meantime they are furnishing a golden harvest to those who do not scruple to reap it.

The efforts of the Pennsylvania Legislature to frame a new and more satisfactory Bituminous Mine law, have unfortunately ended in failure. Early in the year a commission was appointed by the Governor to report upon the question, but after sitting for thirty days, such radical differences of opinion were developed that both a majority and minority report was presented. The former, while excellent in many respects, yet contained portions both unjust and unwise, and on these points the minority differed ; but their report, on the other hand, showed such evidences of crudeness and hasty preparation, that the Senate Committee, after listening to the arguments of both sides, reported negatively on each. In consequence, the present law, which is in many ways faulty and inefficient, will remain in force for another two years.

That "a prophet is not without honor save in his own country," is sometimes due to his insignificance at home, and sometimes to the fact that the source of his inspiration is there too common and well known. A consciousness of this doubtless induced a Mr. Herbert C. Jones, of Toronto, — whoever he may be — to favor an American journal with certain statistics ingeniously culled from the REVIEW and government blue-books, trusting, we suppose, that distance would imprint the stamp of originality upon them. But the "rage for scribbling" appears to have blinded Mr. Jones to the fact that our friends across the line are, as a rule, fairly well acquainted with the state of mining affairs in the Dominion, or he would have certainly restrained his fanciful comments on them, and not have exposed his ignorance to the eyes of men in remarks such as "asbestos has not yet received any attention, though it abounds in rare quantities." If authors of his calibre would be content to remain in the modest retirement intended by nature, or at least expend their talents in the writing of prospectuses, for which their style is much more suited, they would materially advance the interests of and increase the interest in mining journals.

It is understood that in the course of a few days enquiry will be made by one of the Nova Scotian members of the House of Commons as to the size on which it is intended to publish the geological maps of Nova Scotia. We shall possibly arrive then at the true inwardness of the "masterly inactivity" so long shown by the worthy Deputy Head. His explanations, if he makes any, will be interesting.

The Antigonish *Casket* of May 28th, after quoting the article from the REVIEW of January, on the geological map of Nova Scotia, adds :—

> "A good deal of public money has been expended on a geological survey in Nova Scotia. The expenditure is a proper one, as the mineral resources of the country are thus ascertained. To make the knowledge thus gained of practical service, it is necessary to publish maps showing the results of the survey. This has been done satisfactorily for Cape Breton, the scale of the maps being one inch to the mile. But now that maps of the counties of Antigonish and Pictou are being prepared, Director Selwyn has made the mistake of reducing the scale to a quarter of an inch to the mile. The publication of the maps is but a small part of the total cost, the survey itself being the chief item, and it is false economy to restrict the means of indicating the result of the survey. It is like putting down an expensive foundation for a house and then building a shanty upon it."

The death is announced of Capt. F. P. Warren, R.N. He was a prolific inventor, his patents including a new form of lifeboat, cooking stoves and pots, lubricants for engines, dog biscuits, horse-harness, etc. Further eulogy is needless !

The report of an alleged discovery of asbestos on the Annapolis River has afforded an opportunity for the *Gold Hunter* of Queen's Co., N.S., to surprise the world with some remarkable information regarding the Quebec mines, in these words: "There are two asbestos mines in the Province of Quebec. They are worked by hand drills, and the seams are from one to four inches wide." 'It is well to be first in one's own line,' and certainly for crass stupidity and marvellous mis-information, the *Gold Hunter* can easily keep the lead against any competitor that we have yet seen, formidable as some of them are. It would not have been so surprising in an ordinary provincial newspaper, which at times will display a profundity of ignorance really astonishing, but there is no palliation for such a gross blunder when committed by a paper, ostensibly, at least, identified with a section of the mining industry. The following list of companies mining asbestos may enlighten it somewhat as to the status of the industry in Quebec:

American Asbestos Co.,	Black Lake,
Anglo-Canadian Asbestos Co.,	Black Lake,
Allan & Fleming,	Portland,
Beaver Asbestos Co.,	Thetford,
Bell's Asbestos Co.,	Thetford,
Brompton Lake Asbestos Co.,	Brompton Lake,
Bowie Mine,	Portland,
Johnson's Asbestos Co.,	Thetford,
Jeffrey Mine,	Richmond,
King Bros.,	Thetford,
Laurier Mining Co.,	Black Lake,
Megantic Mining Co.,	Coleraine,
Scottish-Canadian Asbestos Co.,	Black Lake,
Templeton Asbestos Co.,	Templeton,
Thetford Mining Co.,	Thetford,
United Asbestos Co.,	Black Lake,
Ward Bros.,	Thetford,
Wolfestown Asbestos Co.,	Wolfestown.

The value of last year's output from these mines was $1,039,661. As to the "working by hand drills," these were discarded years ago, and plants are now installed in their place that might well be taken as an example by some mines in the *Gold Hunter's* neighborhood.

The Massachusetts Institute of Technology affords to persons desirous to acquire a knowledge of mineralogy the advantage of a very cheap and practical course. A few minerals and question papers are mailed to the student, who is expected to study for himself their obvious properties and mail his answers to the professor. The work is corrected and more specimens and questions sent with a blowpipe, and the student referred to some elementary text book for help in his simple assays. The question papers are corrected as the work proceeds, and at the end of a course through some seventy specimens a sufficient knowledge of mineralogy is acquired to enable a prospector to know the ores he may find. The fee for the course is $2.50. Could not such work be done by a Canadian university?

That remarkable journal the Halifax *Critic*, whose avowed object it is to be a sort of "omnium gatherum" of political, financial, commercial, mining and general news, edited by the aid of paste pot and scissors, has once more been seduced from the "straight and narrow path" to revel in fanciful imaginings on the subject of asbestos mining. The last number of the Review having apparently been all cut up and, as much as possible, inserted in previous issues, in an unfortunate moment the editorial shears fell upon the *Gold Hunter* and excerpted therefrom that extraordinary paragraph on the "two asbestos mines in Quebec, worked by hand drills," that has excited our surprise and drawn forth our comment in another place. An utter want of originality, even in such extraordinary perversions of the truth as this, has always been the *Critic's* bane, and until it attempts to write its own articles it will never attain that rank in Nova Scotian journalism to which we suppose it aspires. If it will accept our advice it will not lend so ready an ear to the opinions of other small provincial papers, but will endeavor to do a little amateur collecting of mining notes itself, whereby it may, perhaps, improve somewhat—it cannot possibly become worse or more unreliable.

The last meeting of the Asbestos Club was held at Thetford on May 23rd. The attendance was large, and the membership roll was further added to by the election of sixteen gentlemen to the Club. An interesting paper on "The Electric Drill" was read by Mr. H. J. Williams, of the Beaver Asbestos Company, being his impressions regarding the future of electricity in mining operations.

We much regret to learn that since then the Club House has been burnt together with all its contents. This is a serious blow, but we trust that, like the Phœnix, the Asbestos Club will rise from its ashes to a renewed period of activity and prosperity.

The editor of a certain would-be financial, mining, commercial, *olla podrida* sort of a journal styled the *Lighthouse*, published in London, Eng., is amusing himself in the manner of a small dog barking at a big one, by writing a series of letters in his most valuable publication, ostensibly addressed to, and viciously attacking, Bell's Asbestos Company. We have a hazy idea that they are meant to be in the style of the famous Letters of Junius—we apologize to the Shade of the latter for hinting at the comparison—but if so, they are woefully below the mark, containing no true satire but much vulgar innuendo. One question in particular attracts our attention: "Is it true that Canadian Government geologists have reported unfavorably upon the Bellmina property and express an opinion that as an asbestos mine its value is nil?" It is well known that the members of the Geological Survey of Canada are absolutely forbidden to report upon any property whatsoever, so that the sting of this editorial wasp loses its power altogether. By the way, we wonder what prompted this valiant but puny onslaught? Did the *Lighthouse* fail to receive an advertisement, or, like the gypsies, was its hand not crossed with a silver coin? Furthermore, how much would it cost to effect a change of tune and produce an outburst of adulation?

Having seen the impulse given to mining matters in Ontario through the report of the Royal Commission, the Alberta press have now commenced an agitation for a similar enquiry to be made respecting the mineral resources of their Territory. They urge that if Ontario with its large population and with a considerable section already engaged in mining, needed a public commission to attract public attention to its natural wealth, much more does Alberta, a sparsely inhabited Territory, require such a commission to make known to the world the nature and extent of its minerals. These are many and varied. Iron, copper, galena and other ores are to be found in the Rockies, but the great products of the Territory are coal and petroleum, which are found over a very wide extent of country and apparently in paying quantities everywhere. Whether a commission would be granted is another thing. The reports of the Geological Survey have made evident the vast resources of that part of the country, but the economic value of the coal, for instance, is as yet very small, on account of the absence of any market. Altogether we should not think that the time is yet ripe for an enquiry of this sort, though perhaps the Geological Survey might be directed to prepare a special report on the subject.

We regret to learn that the Cumberland Coal-Owners' and Miners' Conciliatory Board has broken up, the miners having refused to abide by Rule 14, which says that questions of a general adjustment of district wages shall be brought before the full Board, and, in case no agreement can be arrived at, a single arbiter shall be appointed, and his decision shall be final and binding on all parties. The difficulty arose in connection with the proposed reduction of 10 per cent. in miners' wages, and the rupture took place at a meeting of the Joint Committee at Workington. It is a very great pity that this should have occurred, for the Board has been the means of smoothing over many of the little differences between the coal-masters and men, which may now cause serious friction.

A six-foot vein of coal, of very good quality, has been struck in No. 3 level of No. 1 shaft of the New Vancouver Coal Company's collieries, at Nanaimo, B.C. The company has for many years been working in a very faulty field, but it is thought that they have at last struck the great deposit they have searched for so long—a deposit which is believed to extend under the Nanaimo harbor, Protection Island and under the channel connecting the gulf with the harbor. If all that is said of it be true, this find will be of immense importance to the surrounding country, while it will very materially enhance the interests of the company, who well deserve their good fortune after such a long struggle against difficulties.

The production of Bluestone is the subject of the latest bulletin issued by the United States Census Office, under the supervision of Dr. David T. Day. This stone, which is a variety of sandstone, is, on account of its great hardness and durability, largely used for paving as well as for building purposes.

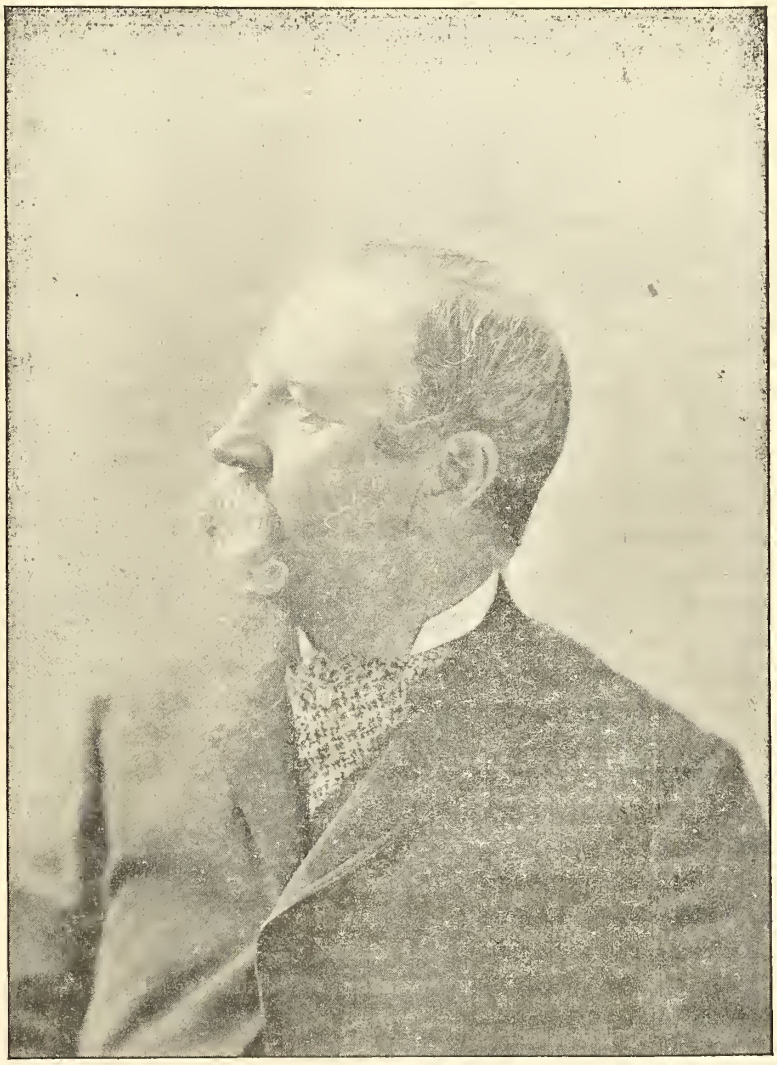
Our Portrait Gallery.

[A series of portraits and biographical sketches of Canadian mining engineers, mine managers, inspectors, geologists, explorers, etc.]

No. 12.

Mr. John Rutherford, Stellarton, N.S., the first Government Inspector of Mines for the Province of Nova Scotia.

One of the most widely known of the men engaged in the mining industry of Nova Scotia is Mr. John Rutherford, the first Inspector of Mines, whose genial, cordial disposition has gained for him the high esteem of all his acquaintances, and whose intelligence, keen observation, and conscientious, ardent advocacy of reforms in mining procedure have been invaluable to that province.



Yours truly
Jno. Rutherford

Mr. Rutherford is a native of the County of Durham, England. He was educated at a private school, and at the age of sixteen was placed with a civil engineer of considerable repute, who was then superintending dock and other works at Hartlepool. As a fitting preparation for the mechanical knowledge so essential in practice, two years were spent in the engine building shops of the now well known Hartlepool engine works of Thomas Richardson & Sons, which were then in course of formation. Mr. Rutherford had charge in rotation of all the screwing, turning, planing and boring machines, and thus gained a practical knowledge of machinery that was of much value in after life.

A dullness of trade and other circumstances led to the abandonment of the profession of civil engineering and to his being articled to Mr. George (now Sir George) Elliot, the eminent mining engineer and coal owner, whose first pupil Mr. Rutherford was. On the completion of his term, he was placed in a position that enabled him to gain an intimate knowledge of the difficulties in sinking through the the Magnesian limestone and beds of quicksand, and the mode of overcoming them, at the Seaham and Seaton collieries, then being opened by the Marquis of Londonderry and others.

About this time the railway mania was in full force, and engineering help was in great demand. Mr. Rutherford accordingly entered the office at Newcastle-on-Tyne of the late Mr. Sopwith, who, with his partner Mr. Scott, had a large amount of surveying and planning in hand, and he spent several months in that first-class establishment. A mining assistant being required by the manager of Lord Durham's extensive collieries, he applied for and obtained the appointment, which he held for some years. Subsequently, he conducted the operations at the Shirecliffe colliery, in the County of Durham, and at a colliery in Northumberland, at which the production of coke for iron smelting was an important part of the business.

In 1865 a delegation to England from Nova Scotia made inquiry, among other matters for which it was sent, for a competent person to act as Inspector of Mines for that province, in which the development of the mineral resources had begun to assume an important aspect, and mining operations were in consequence receiving general attention, and Mr. Rutherford being strongly recommended, was engaged in that capacity, and entered on his duties in the latter part of that year. With the exception of the Sydney and Albion mines, few of the collieries then in operation were of any extent as regards their production, and gold had only lately been discovered. At the close of the year 1866 upwards of sixty gold mines were being actively prosecuted; 3,000 tons of bar iron of a very superior quality had been produced during this and the previous year; twenty-seven collieries had yielded in the same period 1,397,341 tons of coal, and several others were being rapidly brought into a position to augment this produce. Mr. Rutherford has thus witnessed the growth and development of the mining industry of Nova Scotia for a quarter of a century. He entered upon the duties of his office full of faith in the destiny of a country so rich in mineral wealth as he more and more learned Nova Scotia to be. Believing that to this source the province must look for its progress and prosperity, he strove to establish scientific mining; "to attract foreign capital to the mines, to give greater safeguards to native capital flowing in the same direction, and to find lucrative employment for a growing mining population." His reports to the Chief Commissioner of Mines contain detailed descriptions of the works at the several mines and collieries, with tables shewing the mines worked, the number of men employed, the expenditure on machinery and development, the yield and destination of the products. Practical suggestions are given for the prevention of accidents, for the keeping of mining records, for more systematic working, for the proper ventilation and drainage of the mines and for the storage of coal. By his industry and energy, his uncompromising opposition to unscientific mining, Mr. Rutherford laid a good foundation for his successors, and led to the general diffusion of accurate information regarding the mineral resources of Nova Scotia and the right modes of reaching and working them He earnestly advocated the value of properly constructed plans and carefully drawn up descriptions of mining districts, observing that, in the words of Werner, it is "an obligation—a duty—for us to collect and leave to future generations as much instruction and knowledge as possible on the labors carried on in our mines, whether it be in those that are still worked or in those which have been given up," and a special report of his on the importance of mining records was printed in 1867.

After holding the important position of inspector for six years, he resigned it to become the general manager of the General Mining Association of London, the oldest and at one time the only coal company in operation in Nova Scotia. Respecting this change, the Hon. Wm. Garvie, in his report in 1872, remarked: "The recent resignation of the Inspectorship of Mines by Mr. Rutherford, who enters on a new career in connection with one of our foremost coal mining companies, has deprived the department of a highly efficient, active and valuable officer." The position of general manager he held for five years, during which time the company disposed of much of their mineral property, and subsequently confined their operations to the Sydney and Lingan mines.

After the termination of his engagement with the General Mining Association, Mr. Rutherford followed a private professional practice, and was consulted and employed in important mining questions. In 1881 he made a minute examination of the Albert mines in New Brunswick, and his report being confirmatory of the assumed exhausted condition of that wonderful mineral albertite, the works were in consequence brought to a close. Mr. Rutherford also visited professionally and reported on silver and lead mines in Utah and in Spain.

In 1880, when the sad explosion occurred at the Albion mines, Mr. Rutherford, who was then in the north of England, was summoned to London from the sick bed of his son, by Sir George Elliot, and received instructions to come out to Nova Scotia and assist in replacing the mines in a productive condition. He was subsequently appointed manager, in which position he remained until the Vale and Halifax companies were amalgamated with the Acadia Coal Company.

In the course of his long connection with the coal trade of Nova Scotia Mr. Rutherford has filled various duties in relation to that trade and to mining generally. In 1876 he was examined by the committee on the depression of trade, and again in 1877 by the committee on the coal trade. He was appointed by the Dominion government a member of the advisory board for the Philadelphia Exhibition in 1876, and superintended, conjointly with the late Dr. Honeyman, the collection of minerals sent to that exhibition. For some years he was examiner in mining at King's College, Windsor, N.S., and in that capacity read a paper on the mining profession at one of the Encœnias.

On the establishment by the Nova Scotia government of a board of examiners for granting certificates to candidates for the grades of mine officials, Mr. Rutherford was elected chairman of the board. This position, and his connection with the board, he resigned in consequence of the indifference with which his representations of the inadequacy of the means of instruction open to the miners was received by the Commissioner of Mines. He strongly urged in 1883 the adoption of some system by which the candidates for certificates might have that preparatory knowledge which they lacked; and although no attention was at the time given to his communication, happily a more liberal disposition has prevailed of late, and steps have been taken which will materially contribute to the object Mr. Rutherford has in view, viz., the fitting of the candidates for a higher class of examination.

Mr. Rutherford has been a member of the North of England Institute of Mining Engineers since its formation in 1852, and contributed to the Transactions a lengthy paper on the coal fields of Nova Scotia, which was also published separately in book form. He wrote an article on the minerals of Nova Scotia for Messrs. Selon & Co's Handbook to Canada, 1881, which is printed as an appendix to that publication. Being a great reader, with a good memory, his intelligence, combined with the accuracy with which he can recall incidents in the history of mining during the time in which he has been associated with it, makes him an agreeable companion. He lives at Stellarton, in Pictou County, where his son is assistant manager of one of the collieries under the control of the Acadia Coal Company.

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A Compound-Plunger Hydraulic Pump.*

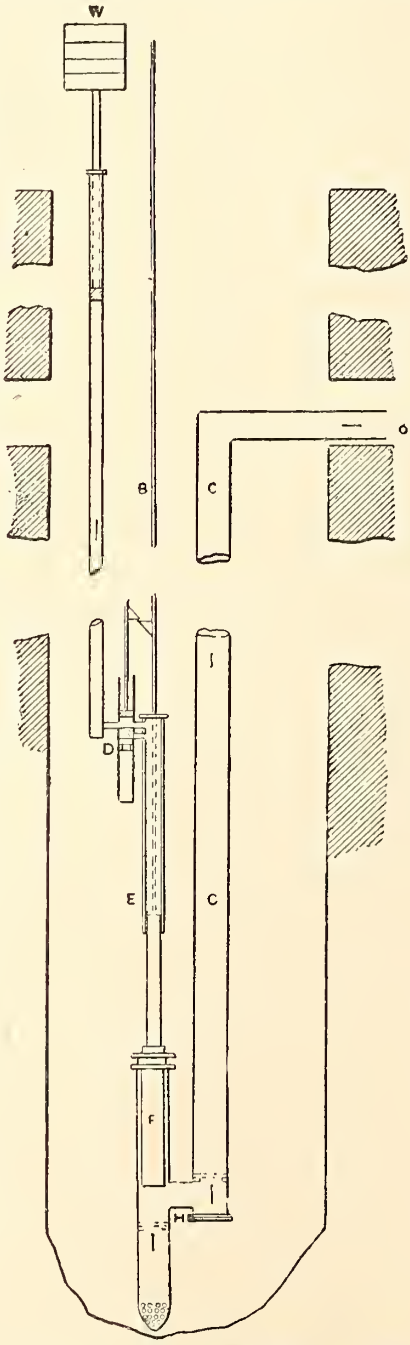
By Ernest R. Woakes, Tólima Mines, Republic of Colombia.

Those engaged in pumping from shafts, or other mining works, may be interested in the following suggestion of what is believed to be a novel method of raising moderate quantities of water against a considerable head.

It is admitted that the ordinary Cornish pump, as generally used in mines, is hard to beat on account both of its extreme simplicity and its easy adaptation to the requirements of mining; its great drawback, however, being the enormous weight of heavy rods and successive plungers that have to be kept in motion, not to mention the necessary "balance-" and "angle-bobs" with all thin accompanying friction and wear and tear.

It is contended that the following method would, to a great extent, overcome these drawbacks; though no doubt many old miners may say it would also introduce new ones. Possibly this may be the case. It is only desired that this pump may be judged upon its merits.

The chief novelty of the method consists in employing the almost unlimited pressure obtainable from a high column of water augmented, if necessary, by a hydraulic ram or press at the top, to work a small diameter piston or plunger at the bottom of a shaft or well. This high-pressure, indicated at E in Fig. 1, transmits power direct to a larger diameter plunger, F, constituting, together with the ordinary higher pieces, valves, and wind-bore, the actual pump which raises the water, by column C, to the adit-level or other discharge placed as far as possible below the head of the high-pressure column A and ram W.



COMPOUND-PLUNGER HYDRAULIC PUMP

It will thus be seen that it is only necessary to maintain a pressure on the small piston E, equal to that on the larger one, F, by means of the small but high column of water A in order to cause F to descend, and thus force the water up through C. The up-stroke is accomplished by a small water-wheel, or other engine, connected to the light rod or wire rope B, this having only to raise the weight of the actual plungers and fill the H-piece with water from the tank or sump. The equilibrium-valve, shown at D, for regulating the admission and the cut-off of the water from the column A to the cylinder E, is also worked by this rod. Of course the amount of water used in E is lost at each stroke, and has to be taken into account in the amount raised by F. This quantity, however, is small, as will be subsequently shown. Thus it will be seen, that instead of a large engine and heavy working parts, a small one with light connections can be used; the weight of the plunger, &c., only being balanced by a small "bob" in the ordinary way. The difficulties encountered in shafts, and especially in inclines, would thus be minimized. As a set-off to this it may be necessary in most cases to keep the ram running at the surface in order to maintain the pressure on the small piston by a closed and continually descending column of water, the waste from which is maintained at the top by the ram and which after doing its work in the high-pressure cylinder at the bottom of the shaft, is pumped up again as far as the discharge by the large plunger which it actuates.

If desirable, two or more sets of plungers can be worked at different stations in the same shaft or well from the same high-pressure column, the sizes of the various plungers being varied to suit the pressures to be overcome and the quantity of water to be raised.

In order to demonstrate more clearly the working of the pump, the following example may be taken:—

A shaft 700 feet deep with the adit or discharge-level 100 feet below the surface so that the water, say 100 English gallons per minute, has to be raised against a head of 600 feet.

High-pressure plunger, 3 inches diameter.

Low-pressure plunger, 10 inches diameter.

Working at 6-feet stroke, and 6 strokes per minute.

Capacity of high-pressure cylinder, 10.5 gallons per minute.

Capacity of low-pressure cylinder, 121.5 gallons per minute.

Difference 111 gallons per minute, which is the amount of water to be raised.

The pressure on the 10-inch plunger is 260 pounds per square inch, making the total pressure on its area 20,400 pounds.

In order to produce an equal pressure on the 3-inch piston a pressure of 2,900 pounds per square inch must be maintained, which will give 20,470 pounds for the total pressure on the area of the 3-inch piston.

This pressure can be supplied by a 19 horse-power ram at the top of the column.

The power required to raise the plungers and work the valves could not be more than 5 to 6 horse-power, so that the whole system would be worked for an expenditure of 25 horse-power.

To do the same work with a Cornish pump, consisting of three plungers and one lift, would require about 30 horse-power, so that there is a slight gain in this respect with the method under discussion.

It may be said that the above pressures would be an obstacle to the successful and economical working of the system, but it is believed that by using cast-steel instead of cast-iron, in the parts subjected to high pressures, this objection would be removed. It is certain that the present tendency in all machinery is to the use of high initial pressures.

The above example could, of course, be modified to almost any extent to suit individual cases, and is only quoted to illustrate the practical application of the principle. The duplication of plungers, as before mentioned, would reduce the actual pressure on any one system.

In situations where there is a sufficient difference in altitude between the highest convenient point near the pit's mouth and the adit- or discharge-level, and where the amount of water to be raised is small, the ram at the surface could be dispensed with, the excess of natural pressure in one column overcoming that in the other.

In conclusion, it may be added that th same principle could be employed to compress air in the bottom of a shaft, the air-cylinder replacing the large plunger and casing, in which case the initial pressure required would be much less than for the pump, though, of course, the work of the mine-pump would be augmented by the amount of water used in the high-pressure cylinder.

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The extravagant expectations which many respectable metallurgical authorities have based upon the extraordinary reductions recently effected in the cost of producing aluminum have been contradicted by actual experience of the metal's capabilities; but there is no doubt that aluminum and its alloys will take an important place in the metallurgy of the future. With the price reduced only a very little from present rates, there is a strong probability of aluminum-bronze very largely displacing brass. It is as an alloy with other metals that the greatest extension in the use of aluminum is at present promised, researches in that direction being now industriously pursued.

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*Trans. Am. Inst. Mining Engineers.

CORRESPONDENCE.

The Shaw Gas-Testing Machine--Some Unique Correspondence.

SIR,—I notice in the May number of the *Colliery Engineer*, a quotation from your paper, in reference to the report of the coroner's jury on the Springhill disaster, which would imply that I had misquoted the jury's report. I can only say in answer that the report in question referring to Shaw's Test Instrument was copied from the *Colliery Engineer* of April number, page 202.

It further appears that my son-in-law Mr. Jos. R. Wilson, while representing me in Canada last summer, made the acquaintance of Mr. H. S. Poole at Stellarton, agent for the Acadia Coal Co., and visited that gentleman's mines, the MacGregor, and while there found the gases in a very bad condition, so much so that pure C. H4, or carburetted hydrogen was found rushing into the mine to such an extent that the condition of affairs called forth from him an exclamation of surprise.

That night Mr. Wilson exhibited my Test Instrument at Stellarton and tested with it the gases from the MacGregor pit before H. S. Poole, Chas. Fergie, Mr. Rutherford, and about twenty other mine officials from that district, and found that the outgoing current or return air contained two and eight-tenths of fire damp, *which will speak for itself*. He tested many other gases and proved the instrument sensitive to the presence of $\frac{1}{1000}$ part of ignitible gas in the air, or the one-tenth of one per cent. All parties present were unanimous in their endorsement of the apparatus, and Mr. Poole was particularly impressed.

The enclosed extract from a letter will show his real sentiments.

STELLARTON, NOVA SCOTIA,
THE ACADIA COAL COMPANY,
September 3rd, 1890.

Joseph R. Wilson, Esq.,
Queen Hotel, Halifax.

DEAR SIR,—I was much interested in your exhibition of Shaw's Apparatus for Detecting Mine Gases, and I have much pleasure in stating that so far as such an exhibition enabled me to judge of its merits, it analyzed percentages with greater accuracy than any ready appliance with which I am familiar.

I am, Dear Sir, yours truly,
HENRY S. POOLE.

In view of the dangerous condition of the MacGregor mine Mr. Wilson urged Mr. Poole to equip himself with the Shaw Inspector's instrument, and Mr. Poole promised to ask Mr. Clendinning, his president, as soon as possible for permission to order one. There the matter rested. Mr. Wilson then exhibited the instrument at Westville, and it received the following endorsement :

OFFICIAL ENDORSEMENT OF THE SHAW MACHINE IN CANADA.

WESTVILLE, N.S., Sept. 19, 1890.

We, the undersigned, are satisfied, after the most crucial tests, that Shaw's Instrument for detecting the presence and percentage of explosive gases is the only instrument extant by which a superintendent can know the true condition of his mine, and we recommend its introduction to use at all mines.

ROBERT SIMPSON,
Civil and Mining Engineer.
CHARLES FERGIE,
General Superintendent Intercolonial Coal Co.
WILLIAM MADDEN,
Deputy Inspector of Mines for Nova Scotia.

After which Mr. Wilson returned to the States and left the instrument in charge of Mr. Chas. Fergie, manager of Drummond Colliery, Westville.

On December 1st, 1890, Mr. Wilson wrote to Mr. Poole advising him urgently to buy a Shaw machine on account of the dangerous condition of his mines. Mr. Poole replied on December 6th, 1890, as follows :—

[COPY].
STELLARTON, NOVA SCOTIA, DEC. 6th, 1890.

To Joseph R. Wilson, Esq.,
915 Ridge Avenue, Philadelphia, Pa.

DEAR SIR : The receipt of your letter of the 1st inst., has gratified me exceedingly, and as I understand Mr. Fergie to say he declines to buy the machine you left with him, I shall be pleased to give $250 cash for it with bags, &c.

Yours very truly,
(Signed) H. S. POOLE, Agent.

This we declined, as the price of the instrument is $500 and cannot be sold for less.

All of this goes to show that the instrument was well received in Canada, and it is surprising to me that Mr. Poole should turn round and belittle himself in the eyes of the scientific public, after once having been quoted as an authority on the same subject. Mr. Poole's action under these circumstances is unaccountable to me.

The action of this gentleman on the Springhill verdict with reference to the Shaw machine, is to be regretted for his own sake. He knew in his heart that the instrument was invaluable and has testified to its merits over his own signature. I personally know nothing of the jury's report except what was published in the papers.

With reference to your editorial on the subject of Shaw's Gas Testing Machines, the tirade of abuse and undue comparison proceeds from a lack of knowledge on the subject and the influence of prejudiced opinions of others. Could you have seen the instrument in operation you would have had nothing but praise for it, both from a scientific and a practical standpoint. Its precision and accuracy are beyond question, and its use must become universal.

I enclose you a few endorsements of the several thousands received, and I trust, since you have published an article against my instrument and method of introduction, that you will insert my reply.

Very truly yours,
T. SHAW, M.E.

PHILADELPHIA, May 19th, 1891.

SIR : I thank you for yours of the 21st with the enclosed papers. Personally I have not the slightest objection to my statements and letters respecting the Shaw machine on the Shaw system being published at any time Mr. Shaw cares to do so, provided they are not garbled, but published with those of Mr. Wilson, his representative, showing the context.

My letter in your March issue expressed views identical with my letter to Mr. Wilson, of September 3rd, 1890, and I will again with pleasure repeat what I have said already, that for occasional and special tests the Shaw machine presents great advantages; that I would gladly see one in the hands of the deputy inspectors, and gladly have the use of one myself; but at the same time I must continue to most emphatically protest against blatant assumptions that the use of this machine in connection with the Shaw system will make fiery mines safe. Mr. Shaw is pleased to speak of "the dangerous condition of his mines," and "the gases in a very bad condition," whatever that may mean, and in a way to have your readers believe the use of the machine would change the condition. Does Mr. Shaw wish it to be understood that I had a hand in putting the gas into the coal? I can assure him I was not present at the making of the coal seams. I have only to deal with them as I find them. The gas, which I did not make, but naturally issuing into the McGregor workings, was shown to Mr. Wilson, who, totally unfamiliar with fiery mines, may have been surprised, as Mr. Shaw says, but because of his surprise does Mr. Shaw wish it to be thought that the gas could be frightened to keep back, or that he could blow hard enough to effect that purpose? Mr. Shaw must know that the gas is pent up in the coal under a pressure of many pounds to the square inch, even in some cases of hundreds of pounds, and that when the coal is cut out it has to come, and no silly little ¼ inch pipes can catch it, issuing as it does from every crack and crevice, and carry it away. This is the more evident when the quantity to deal with is considered. Mr. Shaw says Mr. Wilson found in the return air $2\frac{8}{10}$ per cent. of fire damp. Now, as the total air current is about 90,000 cubic feet a minute, this means that the mine is generating 2,500 cubic feet of gas per minute, and if Mr. Shaw were to ask any gas engineer if he approved of ¼ inch pipes for each half a mile long for drawing off that quantity of gas *diluted* with air, he doubtless would get an "unprejudiced opinion." But Mr. Wilson did *not* find the quantity named ; what he did do was to confirm the percentage in one return of the mine only to be less than half that percentage, and $\frac{2}{10}$ less than I assumed. And I would here add that with Liveing's gas indicator, which we use, small percentages can be approximately found, and further, that machine is portable, which Shaw's is not, and it is safe to be used in the pit, which Shaw's in its present form is not.

Mr. Shaw says my article was "against his instrument." You will be able to say whether this is so better than I can, but my objections were intended to apply to his *system*, and to the "cure all" power claimed for the machine so applied.

I suppose in taxing me with having "turned round and belittled myself in the eyes of the scientific public," Mr. Shaw hopes to find a tender spot in my anatomy for my venturing to freely express my views in response to your enquiry respecting his machine and system. If by "turning round" he implies a change of respect for the character of men who could invent so clever an instrument on finding they could descend to the methods they adopt for forcing the system on the mining public, he is quite right. I regret exceedingly to see such evident ability so prostituted. Mr. Shaw chides me for referring to the Springhill verdict. In his desire to make capital out of the deplorable explosion, he published a circular giving the verdict and an alleged recommendation from the jury that the government should purchase one of his machines. My offence consists in showing on the authority of the mayor of Springhill, who was the foreman, that the jury *never* made this recommendation If he is annoyed at the exposure of this untruth, he has to thank the tone and style of letter adopted by his representative, Mr. Wilson. You published in your March issue an extract that is sufficient to show the offensive character of his correspondence, and yet most amusingly Mr. Shaw complains of "abuse and undue comparison, from lack of knowledge," &c., objecting evidently to others descending to his own tactics ! In this respect he is doubtless right, but even poor worms will attempt to turn when trodden on.

H. S. POOLE.

STELLARTON, N.S., May 28th.

The precise meaning of several expressions in Mr. Poole's letter, such as "garbling, etc.," not being very apparent, he writes us to say that he referred to the "persistent twist" given to commendations, making them more general and sweeping than intended; as, for instance, his own praise of the machine was limited in application, and yet he is taxed with turning round, when he protests, not against the machine *per se*, but the Shaw system. Regarding the offer of half price for the machine quoted by Mr. Shaw, Mr. Poole says that by taking that part of his letter alone it would appear as though he were only trying to beat Mr. Shaw down in price, but his real intention was to imply that he did not put nearly such a value on the instrument as its inventor, and taken in connection with Mr. Wilson's two previous letters, and his short reply, it was a quiet rebuke of the tone adopted by the latter. Furthermore, he had in anticipation other possible quotations, and if Mr. Shaw wanted to quote further, he should have also shown the Wilson letters, to which he, Mr. Poole, takes exception. With these explanatory remarks, we present the full text of the correspondence between Mr. Wilson and Mr. Poole.

Copy of Correspondence Between Mr. Wilson and Mr. Poole, Referred To.

PHILADELPHIA, Oct. 22nd, 1890.

To Henry S. Poole, Esq.,
Stellarton, N.S.

MY DEAR SIR,—I trust the good impression made on you by the Shaw machine will be the means of making you one of the pioneer superintendents in its introduction and use in Canada. It would be strange if Sir George Elliott were to adopt them in England before you had quite made up your mind as to its utility for the Foord, MacGregor and Vale pits; but this would not be very surprising, as the English Government has already appointed its senior mining inspector, Joseph Dickinson, F.G.S., to report on same to the Home Office, and we believe his report so far has been most favorable. There can be no doubt, Mr. Poole, of the urgent necessity of the adoption of the Shaw machine at your three mines as early as possible—and I feel convinced that you share this opinion—therefore I trust, in the interest of yourself and company, you will bring the matter before Mr. Clendinning as soon as he arrives at Stellarton, or if he has been and gone again, send it after him. The Shaw machine is a means of insurance of the highest and most reliable order, and the time is not far distant when the wonder will be—however did we do without it. I see by the papers that Mr. Wills is getting the Foord pit into good shape. An instrument would be very useful to him at present. Give him my regards. I have heard about him from the other side ; also kindly convey my regards to Messrs. Rutherford, Jr. and Sen., and with kindest regards to yourself and Mrs. Poole, and thanks for kind assistance when with you.

Very truly yours,
JOSEPH R. WILSON.

STELLARTON, N.S., Nov. 12th, 1890.

J. R. Wilson, Esq.,
Philadelphia.

MY DEAR SIR,—Special matters having come up lately, I have had my attention diverted from correspondence not requiring immediate attention ; and I regret to find I have left your letter of October 22nd so long unanswered.

I thank you for it and for recalling to my recollection the very attractive experiments you showed here with the Shaw machine. The machine had a strong fascination for me, not only because of its practical value in connection with my profession, but also because of the interest awakened in me in physical research when years ago I studied in the Roy. Coll. of Chemistry, and attended the lectures of Prof. Tyndall.

You are kind enough to suppose that a desire for *kudos* still is in me ; what little I may have had in my salad days is well nigh dead, and is at any rate very difficult to arouse. I find it so much easier to wait for others to work out details and adopt improvements that I am no longer eager to be first. I shall be pleased to see Mr. Fergie acquire one of the Shaw machines and find it practically useful for constant application ; for as I remarked to you I only see use in occasional tests, and then not to an extent that would warrant the purchase of so high-priced an instrument.

With kind regards, believe me
Yours faithfully,
HENRY S. POOLE.

PHILADELPHIA, Dec. 1st, 1890.

Henry S. Poole, Esq.,
Stellarton, N.S.

DEAR SIR,—I am in receipt of your kind favor of 12th ulto., and note your remarks on the Shaw machine with great pleasure, notwithstanding the fact that you consider it an expensive protection. If you are not a man to be credited with a desire for *kudos*, I should like to know where to look in Nova Scotia or Hochelaga for one better calculated to wear the honor with greater dignity than yourself. In this case, I value that very *kudos* which you profess to be indifferent to now, as only fitting for '*opanu*. You are entirely mistaken inasmuch that you only see a use in occasional tests with the Shaw machine, nor can I understand how a man so thoroughly practical, could possibly arrive at such a divergent opinion from the greatest mining engineers and experts in the world, and with all due respect to your professed opinion, if I were called upon to point out a mine in which I considered continuous tests absolutely necessary throughout the day for the safety of life and property, I should immediately refer to the MacGregor, Vale, and Foord Pits, in the vicinity of Stellarton, Nova Scotia. Providence, rather than protective measures, has granted you immunity from serious disaster, but you cannot always expect Providence to avert catastrophe, and I urge you now as I have done before, to avail yourself of the apparatus known as the Shaw machine, and not trust to the treacherous lamp to warn you of danger, when too late; but with diaphragm hand-pump and rubber bags test the dangerous pockets and disused ramifications around your mines, so that you can direct your air currents that way and carry off the highly explosive accumulations by means of ordinary ventilation. Without the Shaw machine, it is impossible for you to know what per cent. of gas you are carrying, and were you to apply the lamp to test the pockets in question, if a high per cent. of gas was present, an explosion would be almost unavoidable. Then again the CO_2 tests connected with the Shaw machine are of the highest importance for the health of the miner and animals, $\frac{6}{10}$ of a foot in a thousand being the extreme permissible amount for health, while in the Foord pit at present I should say you are carrying as high as 2 and 3 per cent. This can also be corrected when its presence is known, by means of increased ventilation. With all these facts in view, your disposition resolves itself into an incongruity in my eyes, for not having availed yourself of this invaluable invention long ago; however, since you do not care to be first, I know that the time is not far distant when you will endeavor to analyze in vain the motives that prevented you from adopting it at sight. As to the matter of cost, \$500; what is that paltry sum that at 5% means only \$25 a year, compared to the protection it now offers over life and property? I do not think logarithms are necessary to work out this calculation.

With kind regards to yourself and Mrs. Poole.

Very truly yours,
JOSEPH R. WILSON.

STELLARTON, NOVA SCOTIA,
December 6th, 1890.

J. R. Wilson, Esq.,
915 Ridge Avenue, Philadelphia.

DEAR SIR,—The receipt of your letter of the 1st inst. has gratified me exceedingly, and as I understand Mr. Fergie to say he declines to buy the machine you left with him I shall be pleased to give \$250 cash for it with bags, etc.

Yours very truly,
H. S. POOLE, Agent.

PHILADELPHIA, DEC. 9th, 1890.

To Henry S. Poole, Esq.,
Agent Acadia Coal Co., Stellarton, Nova Scotia.

DEAR SIR: Your kind favor of the 6th inst. to hand, and am much pleased to receive your offer of \$250 for Shaw machine left with Mr. Fergie, together with bags, etc. Outside of any business consideration, it affords me deep pleasure to see your true nature awakening to the call of science, and I regard the motives which prompt you to make me this offer as a triumph of intellectual manliness and a desire to do that which is right, over a conservative business policy, which although highly commended while everything is going on all right by those who are saved from a modest outlay, yet severely condemned by those self-same people when they realize that to save a few dollars a whole mine and many human lives have been sacrificed and their own financial ruin brought about. It is only then that the blame of a short-sighted policy is thrust upon the management, on the plea that they were not urged sufficiently on the matter, and thus exonerating themselves from any participation, they hold the management answerable to themselves and God for the unnecessary loss of life and property. This is plain language, but so surely as two and two make four, so sure is the foregoing true. I regret that I am unable to accept an offer which I appreciate so much, but the price has been set for the whole world at \$500, and this being a fair price, we cannot establish a precedent for any other sales by lowering it, excepting in the cases of colleges and public institutions, in which latter cases, it is our desire to help scientific research all in our power, and our prices will be in accordance therewith. The machine is most expensive to construct, special machinery having been made for the purpose. The cylinders have to be drawn over steel mandrils by hydraulic machinery, and are correct to the $\frac{1}{20000}$ of an inch. The most skilful mechanics and mathematicians have to be employed; in fact \$500 is a reasonable price.

I will not dilate farther on the uses of the Shaw machine, for their name is legion. You have a proper sense of its merits, and I shall be glad to send you a new one, with all extras for \$568, exclusive of duty, which is \$150 at present, but we have every reason to believe that the Minister of Justice will decide in our favor and admit the instrument free as mining machinery, in which case the cost complete will only be \$568. I sincerely trust that you will consider the great importance of our instruments for your mines, and get your board of directors to take this matter up at the earliest possible date. Just think how useful it will be to you, and how you will be able to know the condition of your mines; why it seems to me strange that knowing of the existence of such a machine a coal operator would be without one any longer than was absolutely necessary to obtain the same. I enclose you a list of what we will furnish you for \$568, f.o.b., Philadelphia; also application blanks.

You will perceive that *you cannot use* ONE instrument for all your mines, but must have ONE for EACH, but we shall be glad to equip one mine at a time, which will be a step in the right direction for your company; a step which I sincerely hope for your sake will be taken soon. With kindest regards, again thanking you for your offer,

I am, dear sir,
Yours very truly,
JOSEPH R. WILSON.

PHILADELPHIA, March 16th 1891.

Henry S. Poole, Esq.,
Agent Acadia Coal Co., Stellarton, N.S.

MY DEAR SIR,—The late disaster at Springhill is a prophetic warning to the mining community of Nova Scotia. The total absence of any definite means of ascertaining the gaseous condition of your mines, urges me to make one more effort to introduce the *only known* appliance for this purpose into the mines of the Acadia Coal Co., and as I have already in former letters, made all the necessary arguments why you should avail yourself of what science offers, I have nothing left to add but this: Unless you avail yourself—and soon too—you may live, like Cowans, to regret that it was ever your misfortune to be a mine superintendent. You know your responsibility—I know the condition of your mines. *Deliberate!*

With kindest regards to yourself and Mrs. Poole.

Very truly yours,
JOSEPH R. WILSON.

MARCH 19TH, 1891.

Mr. Joseph R. Wilson,
915 Ridge Avenue, Philadelphia.

SIR,—I can hardly believe that through your continuous advocacy of the so called Shaw system of signalling in mines, you are already so lost to all sense of decency as not to know your letter of the 16th inst. is grossly insulting: it is cruel, heartless, devilish. The pursuit of the "almighty dollar" must have indeed deprived you of every dreg of manhood before you could write as you have. You would have me die would you, with the wails of widows and the fatherless in my ears unless I buy your rights! Take care, curses sometimes come home to roost.

Yours, etc.,
HENRY S. POOLE.

PHILADELPHIA, March 24th, 1891.

Henry S. Poole, Esq.,
Agent Acadia Coal Co., Stellarton, N.S.

MY DEAR SIR: In reviewing my letter to you of the 16th inst. I fail to see any such objectionable references as you make note of in said letter, and you are not warranted in drawing unfriendly inferences or charging improper motives from a communication from any party that has had no other than friendly intercourse with yourself.

If I see impending danger to yourself, and a remedy against the same, I would appear in my own eyes a most ungrateful party if I failed to use the strongest possible language against the real or supposed impending danger.

Very truly yours,
JOSEPH R. WILSON.

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The Nickel and Copper Deposits of Sudbury.*

BY ALFRED E. BARLOW, M.A., GEOLOGICAL SURVEY OF CANADA, OTTAWA.

The presence of large deposits of nickel and copper in the District of Algoma, Ontario, has of late years attracted world-wide attention, in the first place on account of their immense and apparently inexhaustible character, but latterly because of the proposed application of nickel in alloy with steel to improve the quality of the latter. The existence of workable deposits of copper in this region was a fact that had long been known, and as far back as 1770 a company had been formed and attempts made to mine this metal, but the difficulty of procuring and maintaining miners at so great a distance from any centre of civilization, the remoteness of any market for the ore, as well as the absence of facilities for transportation, rendered these first attempts abortive. However, in 1846, owing to the activity in prospecting and locating mineral lands on the southern shore of Lake Superior, and a favorable report by Mr. W. E. Logan, then newly appointed Provincial Geologist, some enterprising Canadians banded themselves together into two associations called "The Montreal Mining Co'y," and the "Upper Canada Mining Co'y." The former company having purchased, amongst others, what was then known as "The Bruce Mines" location, and on account of the richness of the deposit decided to commence active work at this locality, while the Upper Canada Co'y proceeded to develop and work what was known as the "Wallace Mine," at the mouth of the Whitefish River. The Montreal Mining Co'y continued their operations from 1846 to 1865, when, from a variety of causes, the work proving unremunerative, they sold out the whole of their claim to the "West Canada Mining Co'y," who had previously leased and worked the western half of the location under the name of the Wellington Mine. This company continued working till 1876 when, owing to unsatisfactory results, work was suspended and has not been resumed since. The Wallace Mine was chosen on account of its promising character and proximity to civilization, and is chiefly remarkable as having been the first place in Canada in which the presence of nickel had been detected.

According to Mr. Alex. Murray, of the Geological Survey of Canada, who made an examination of the location in 1848, "No true vein can be discovered, but the ore occurs at the contact of quartzose and chloritic slates with diorite, as bunches and strings of pyritous matter, interlaminated irregularly with the slates, and distributed in specks and patches in the diorite. Abundant evidence of disturbance is displayed in irregularities of dip and intrusion of the diorite. The material collected for assay was chosen as free as possible from copper pyrites, but nearly two-fifths of the specimen consisted of earthy materials which might readily be separated by dressing," (See Report Geological Survey of Canada, 1848-49, pp. 42—45.) Dr. T. Sterry Hunt, in his report on this ore, says that "the specimen is a steel grey arseniuret, the species not determined, with white iron pyrites and probably some arsenical sulphuret of iron. The mass, weighing 45 oz., was reduced to powder and submitted to analysis, with the following results:—

Iron	24.78
Nickel, with trace of cobalt	8.26
Arsenic	3.57
Sulphur	22.63
Copper	06
Earthy materials	40.01
	99.31

In the process of washing the ore, the earthy parts being removed by washing, the composition of the ore in 100 parts, as deduced by calculation from the above, would be—

Iron	41.79
Nickel and cobalt	13.93
Arsenic	6.02
Sulphur	38.16
Copper	.10

From the small proportion of arsenic the nickel must in part at least, be present in a state of sulphuret, a fact which is, indeed, made evident by the spontaneous oxidation of the ore. The nickel from this source contained about three parts in a thousand of cobalt. In conclusion, he remarks that in the same bands of rocks we may detect the presence of nickel and cobalt, a prophecy which has since been amply verified.

A mass of copper pyrites from the same mine weighing 9½ lbs. was also assayed, which yielded 11.6 per cent. of metallic copper. Acting on these and other favorable reports, the company began to sink shafts to test the extent and the quality of the ore, and one of these shafts at least attained a depth of 10 or 15 fathoms. Work was carried on energetically for some years, but the enterprise was finally abandoned, as the quantity of ore did not seem sufficient to justify further expenditure.

In his report for 1856, Mr. Alex. Murray (see Report Geological Survey of Canada, 1853-56, p. 180,) mentions the occurrence of a "dingy green magnetic trap" associated with red syenite in the northwest corner of the Township of Waters on Salter's meridian line. Specimens of this trap were given to Dr. Hunt for analysis, and the result of his investigation showed that it contained magnetic iron ore and magnetic iron pyrites, generally distributed through the rock, the former in very small grains; titaniferous iron was found associated with the magnetic ore and a small quantity of nickel and copper. The variation of the magnetic needle near this mass was from ten to fifteen degrees west of the true meridian. It can thus be seen that even at this early period of its history the officers of the Geological Survey were aware of the existence of nickel in this region, and had pointed out the probability that workable deposits would be found. Years passed by and the inaccessible nature of the country deterred prospectors from making very detailed exploration or examination, so that it was not till 1883, when the Canadian Pacific Railway was in course of construction, that the first discoveries of any consequence were made, since which time the whole belt of the Huronian district has been overrun with eager prospectors and miners. A not infrequent accident in newly settled districts led to the first important discovery. Judge McNaughton, stipendiary magistrate at Sudbury, had been lost in the woods to the west of that village, and diligent search was at once instituted for him. A party consisting of Dr. Howey and two others found the judge seated on the small eminence which then marked the site of what is now known as the "Murray Mine." Early in 1884 the Canadian Pacific Railway made a cutting for their main line through this small hill, about 3½ miles northwest of Sudbury, and on July 12th of the same year Dr. Selwyn made a careful examination of the location and pronounced the lode to be one of the most promising he had yet seen in Canada. Other discoveries soon followed, and the McConnell, Lady Macdonald, Stobie, Blezard, Copper Cliff and Evans Mines were all located. At first the wildest notions were entertained as to the extent of these deposits, and the most exaggerated reports circulated as to their value. It was even confidently asserted that these were immensely important discoveries, and would revolutionize the whole copper trade and render other mines then in operation quite unremunerative. Rounded hills of gossan, indicating the presence of the more solid and unaltered ore beneath, occur at intervals for miles in a southwesterly direction, conforming rudely to the strike of the rocks in the vicinity. This circumstance is all that seems to have justified the early discoverers in describing the deposits as veritable mountains of solid ore, many miles in extent and hundreds of feet thick. Closer investigation revealed the fact that these surface gossans everywhere indicate the presence of the ore beneath, and that the ore itself occurs in lenticular masses, entirely separated from one another, whose longer axes correspond with the strike of the enclosing rock. This gossan has resulted, as is usual, from the formation of peroxide and hydrated peroxide of iron, due to the decomposition of the pyrrhotite and chalcopyrite which gives a prevailing red or reddish brown color to the upper portion of the deposit. This covering of iron oxide is sometimes as much as six feet in depth, although usually it is only two or three feet, gradually merging itself into the unaltered ore beneath. During the last few years prospectors have not been idle, and at the present time about twenty very promising deposits of these ores have been "located" and "taken up." The McAllister Mine, now called the Lady Macdonald Mine, was the first property on which any work was done in the summer of 1885, although later in the fall the Evans Mine was opened up and some preliminary tests made. On January 6th, 1886, the Canadian Copper Company was formed with a subscribed and paid up capital of $2,000,000, which was afterward increased to $2,500,000, to operate the Copper Cliff, Stobie and Evans Mines.

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*Read before the Logan Club, Ottawa, March 6th, 1891.

On May 1st, 1886, work was started in earnest at the Copper Cliff mine, and later on in the same year both the Stobie and Evans mines were opened up, and with the exception of a few months last summer, when, on account of some difference with the Canadian Pacific Railway, the Stobie was shut down, these three mines have been in active operation ever since. The chief business of the Canadian Copper Company is done at Copper Cliff, for here they have prepared a well equipped roast yard, two smelting furnaces, laboratory and offices, and other things requisite for carrying on this mining on an extensive scale. The Stobie and Evans mines are provided with excellent rock houses, but all their ore is brought by branch railways to Copper Cliff to be roasted and smelted. In 1889 the Dominion Mineral Company was formed to operate the Blezard mine, and later on they purchased the Worthington mine from the original owners. During the past summer this company have had their smelter in operation, and both their mines are being energetically developed. During the summer of 1889 the Murray mine was prospected under bond by Messrs. Henry H. Vivian & Co., Swansea, England, and in October of the same year they purchased it. About the end of last September. everything being ready, the smelter "was blown in" and set to work on some ore which had been previously roasted. All three companies are now prosecuting the work vigorously, and the output of these mines has already reached very large proportions. The whole district has been prospected, and I think that a very conservative estimate would now place the number of promising deposits at twenty.

The Huronian system in which these ore deposits occur may be regarded as the oldest series of sedimentary strata of which we have at present any certain knowledge. Amongst the more important of these rocks may be mentioned quartzites, greywackés, conglomerates, slates, evenly laminated gneisses, felsites, hydromica, chloritic, epidotic, hornblendic and micaceous schists and narrow bands of cherty limestone. Most of these clastic rocks have been derived from the waste of older felspathic material, and hitherto it has been most generally supposed and stated that the Laurentian gneiss was the source from which the sediments had been derived. The Huronian conglomerates, however, had no pebbles that are undeniably referable to the Laurentian, and the origin of the syenitic, quartzose and jaspery pebbles is still a matter of doubt. The microscope can throw no certain light on the original character of some of these rocks, for very often metamorphism and recrystallization has gone on to such an extent that the former structure has been either partially or completely obliterated. A close study of these uncertain rocks in the field, aided by the use of the microscope in the laboratory, will eventually enable us to assign them their proper place. We have thus numerous sedimentary rocks showing the various stages of this metamorphism, from the typical sandstone or greywacké, composed of the well rounded grains of quartz and felspar, to the compact felsite, which contains no trace of its original clastic structure. Associated with these sedimeneary strata are certain undoubted eruptive and irruptive rocks, among which may be mentioned many varieties of diabase, diorite and gabbro. Besides these igneous rocks, there are some granites and gneisses concerning whose origin many are in doubt. After a close and careful study of these rocks, which have usually been classified as Laurentian, and their relation with the true Huronian stratified deposits, I have been fully convinced of their irruptive nature. These granites and gneisses probably represent the original crust of the earth which has undergone refusion, and was in a molten or plastic condition at a period subsequent to the hardening of the Huronian sediments. The earth gradually cooling from a state of original incandescence, had reached that stage in the process when it admitted of being surrounded by an ocean nearly, if not quite, universal. Then began that tearing down and building up which has since gone on in forming the sediments which subsequently hardened into rocks. The first formed crust was necessarily thin and weak, and it is therefore not surprising that there were frequent irruptions, accompanied by the fusion of the lower portion at least of the first formed deposits.

It is unnecessary here to go into all the facts of the case, as my views have already been stated at some length in a paper read before this club on February 27th of last year. Suffice it to say that the fuller examinations of last summur have served to further strengthen these views. Both clastic and irruptive rocks have been subjected to intense pressure, as evidenced by the extensive cataclastic structure which has been developed in both series of rocks. Frequently the rocks show a pyroclastic origin, and volcanic tuffs and breccias are very commonly met with. The relations of the diabase or basic irruptive rocks with the surrounding sedimentary strata was closely examined in a large number of instances, and revealed the fact that the diabase is apparently of later age, as it breaks through and alters the bedded Huronian. The occurrence of these masses of diabase with a surrounding breccia or agglomerate in many cases would seem to point to the fact that they are the bases of Huronian volcanoes, which continued in action after the latest sediments had been deposited. Some of these diabasic masses send out dykes which ramify through and alter the surrounding strata, these dykes frequently containing fragments of highly metamorphosed Huronian quartzite. These irruptive masses are usually lenticular, although occasionally rudely circular or oval in outline, and their longer axes correspond in general with the strike of the enclosing rock. They vary in breadth from a few chains to half a mile, or even more, and frequently extend for miles in length. The origin of the nickel and copper is closely connected with this diabase or gabbro, and the formation of the fissures containing these ores was no doubt due to the disruptive forces of the intrusion, and the contraction caused by the subsequent cooling of the igneous rock matter. These fissures were necessarily most frequently formed along the line of contact with the cooler sedimentary strata although in certain cases they were formed in the midst of the igneous mass itself. In nearly every case, therefore, the deposits of nickel and copper occur close to the contact of the diabase with the stratified rocks, although in a few cases they are found in the diabase near its junction with granite or micropegmatite. Another proof of the common genesis of these ores and the enclosing diabase is that the diabase itself commonly contains these sulphides disseminated through its mass, these impregnations occasionally forming such considerable and rich deposits as to be workable.

All geologists who have examined these deposits agree that they are not true fissure veins, and although at times a certain sloping surface is obtained which seems to have a uniform inclination, yet it seems certain that there are no regular walls in the miner's sense of the term, and at both sides of the deposits the enclosing rock is impregnated more or less with the pyritous matter. Though mining is thus rendered somewhat dfficult and uncertain on account of the absence of the walls and irregularity in the distribution of the ore, so that there is no means of knowing in what direction to drive the levels, this uncertainty is more than compensated by the extent and massiveness of the deposit when found. The ore bodies like the masses of diabase with which they are so intimately associated are lens or pod-shaped and "pinch out" in both directions. This structure is also characteristic of their downward extension, and the deposits have been very truly likened to a string of sausages, so that when one lenticular body of ore gives out another commences close at hand, which in its turn gives place to another, and though at the Copper Cliff they are down about 600 feet on a slope of 45°, the quantity and quality of the ore shows no diminution. I have occasionally found true veins of quartz holding this pyrrhotite, but such evidences of secondary action are extremely rare and proves nothing in regard to the origin of the more massive deposits. The ores and the associated diabase were therefore in all probability simultaneously introduced in a molten condition, the particles of pyritous matter aggregating themselves together in obedience to the law of mutual attraction. The ore bodies were, therefore, not contemporaneous with the stratified Huronian, although there is nothing to prove that they do not belong to the close of the Huronian period. Mr. Ferrier of the Geological Survey has noticed the occurrence of this nickeliferous pyrrhotite in a specimen of chloritic schist and gneissic granite, which had been taken to show the contact between the two rocks. The pyrrhotite is disseminated through both rocks, and its occurrence here in the Township of Dill at the junction of what has been called Laurentian would seem to be another proof of the irruptive origin of this gneiss.

The ore itself is a mixture of pyrrhotite, a monosulphide of iron ($Fe_7 S_8$) and chalcopyrite, a sulphide of copper and iron ($Cu Fe S_2$). The two minerals are not so intimately commingled as to form a perfect homogeneous mass, but one may be described as occurring in pockets, spots, bunches or threads in the other. The chalcopyrite is not so closely intermixed with the pyrrhotite, but isolates itself rather in spots and patches enclosed by massive pyrrhotite, so that it is not hard to separate considerable masses of chalcopyrite that will assay over 30 per cent. of copper, or pyrrhotite that will only show traces of that metal. In practice, however, careful examination and trial have proved that the two minerals are too intimately associated to make sorting by hand at all practicable, and the pyrrhotite is very often so feebly magnetic as to preclude the possibility of separation by magnetism. Although the chalcopyrite seldom occurs free from the pyrrhotite, large and massive deposits of the latter occur comparatively free from copper. In this connection Dr. Peters mentions a slope which, having furnished about 2,000 tons of pyrrhotite, gave place, just before the end boundaries were reached, to a deposit which afforded nearly 20 tons of almost pure chalcopyrite. In some instances these ore bodies show a brecciated character, large angular or partially rounded boulders or "horses" of almost barren rock being mingled with the ore, which seem to evidence the disruptive force of the intrusive mass, while in others, as at the Worthington mine, the diabase in which the ore occurs has developed a concretionary structure while cooling, and large irregularly rounded concretions, which on weathering, peel off in concentric layers, are cemented together, so to speak, by a very pure chalcopyrite and highly nickeliferous pyrrhotite. The concretions themselves usually contain more or less pyritous matter disseminated through them, but are usually cast aside as too barren for the roast heap. The pyrrhotite varies in color from steel-grey to bronze yellow, and the chalcopyrite is the usual brass or deep yellow color. Both tarnish readily, and very beautiful iridescent specimens can be easily obtained from the ore heap or scattered around the works. These sulphides, therefore, may be said to occur in three distinct ways—

1st. As contact deposits of pyrrhotite and chalcopyrite situated between the clastic rocks, such as felsites, quartzites, etc., and irruptive diabase or gabbro, or between these latter and granite or micropegmatite. Good examples of the former are furnished by the Evans, Stobie and Copper Cliff, while the Murray mine may be cited as illustrating the latter.

2nd. As impregnations of these minerals through the diabase or gabbro, which are sometimes so rich and considerable as to form workable deposits. These sulphides are in no case present as disseminations through the clastic rocks very distant from the diabase or gabbro, which seems clear evidence that they have been brought up by the latter.

3rd. As segregated veins which may have been filled subsequently to the irruption which brought up the more massive deposits. These veins are not very common, although certain portions of the more massive deposits may have been dissolved out and re-deposited along certain faults and fissures.

The composition of the ore varies according to the preponderance of either the pyrrhotite or chalcopyrite in the specimen examined. The pyrrhotite may be said roughly to be composed of 40% sulphur and 60% iron, with a varying proportion of the iron replaced by nickel, while the chalcopyrite contains 35% sulphur, 35% copper and 30% iron. The mines ~~of the Canadian Copper Co'y, as the name of the company indicates~~, were first opened for their copper contents, and it was not until considerable work had been done that nickel was discovered to be present in the ore. A large shipment of ore had been made to New York, and a chemist there who was making a volumetric determination of the copper contents by the Potassium Cyanide process, was struck by the great variation in his results, which led him to make a more minute examination of the ore, when he found that nickel was present. The ore has now become of more value on account of its nickel than its copper contents, and Dr. E.D. Peters himself greatly doubted if the mines would pay to work for copper alone. The percentage of nickel and copper varies greatly, as might be expected, but assays of nine samples from the different mines of the Canadian Copper Co'y, made in November, 1888, will show the usual percentage of these metals. These assays were made by Mr. Francis L. Sperry, and show a range in the percentage of nickel from 1.12% to 4.21%, with an average of 2.38%, while the copper varied from 4.03% to 9.98%, with an average of 6.44%. A minute proportion of cobalt also occurs in the pyrrhotite, usually about $\frac{1}{50}$th as much as the nickel present. Mr. G. C. Hoffman assayed four samples from this district which I collected last summer, and these showed the nickel contents to vary from 1.95% to 3.10%, with an average of 2 25%. Three of these samples contained traces of cobalt, which are included in the above percentage of nickel. The nickel is usually spoken of as replacing an equal quantity of iron in the pyrrhotite, but the discovery of undoubted crystals of millerite or sulphide of nickel 150 feet below the surface at Copper Cliff Mine, as well as the more recent recognition of polydymite, a ferriferous sulphide of nickel, at the Vermilion Mine, in the Township of Denison, seems to justify the assumption that in the more highly nickeliferous deposits of the region at least, the nickel is also present as a sulphide, disseminated through the ore mass like the iron and copper.

This view is also borne out by Dr. Hunt's analysis of the ore of the old Wallace mine which seems precisely analogous to some of the richer deposits nearer the Canadian Pacific Railway. Traces of gold and silver, as also platinum are also usually found in these ores, and in this connection it was thought advisable to call your attention to the detection of what Messrs. Clarke & Catlett call a "platiniferous nickel ore from Canada." They say (see article xxxix, page 372, *American Journal of Science*, 1889): "During the autumn of 1888 we received, through two different channels samples of nickel ores taken from the mines of the Canadian Copper Company at Sudbury, Ont. From one source we obtained two masses of sulphides to be examined for nickel and copper, from the other came similar sulphides together with a series of soil and gravel-like material (gossan), 7 samples in all. In the latter case an examination for platinum was requested, and in 5 of the samples above mentioned it was found the gravel yielded 74.85 ozs. of metals of the platinum group to the ton of 2,000 lbs. The sulphide ores submitted to us from Sudbury were all of a similar character. They consisted of mixed masses in which a grey readily tarnishing substance was predominant with some chalcopyrite, possibly some pyrite and a very little quartz. Two samples were examined in mass: one gave 31.41% nickel with a little copper, and the other gave 35.39% nickel and 5.2% copper. The nickel mineral itself proved to be a sulphide of nickel and iron, and as ores of that composition are not common, it was thought advisable to examine the substance further. It is steel-grey, massive and exceedingly alterable in the air with a Sp. Gr. of 4.5. An analysis of carefully selected material gave :—

Nickel	41.96
Iron	15.57
Silica	1.02
Copper	.62
Sulphur	40.80

These figures give approximately the formula $Ni_3 Fe S_5$. Neither cobalt nor arsenic could be detected. If we deduct silica together with the copper reckoned as admixed chalcopyrite and re-calculate the remainder of the analysis to 100% we get the following figures :—

Nickel	43.18
Iron	15.47
Sulphur	41.35

In short the mineral has the composition of $Ni_4 S_5$ with about ¼th of the nickel replaced by iron, which seems to agree with Laspeyres polydymite of which it is doubtless a ferriferous variety. Probably in most cases the nickeliferous constituent of pyrrhotite is millerite, but other sulphides like polydymite may occur too. The polydymite which was selected for the above analysis came from the mass in which the average of 35.39% nickel and 5.20% copper had previously been found.

The mass weighed several kilograms and was remarkably free from quartz. The same mass, with two smaller pieces resembling it, were also examined for platinum. The results were as follows, "A" representing the large mass in which the polydymite was determined :—

A...	2.55 oz.	platinum per ton, or	.0087%
B...	1.8 oz.	" "	.0060%
C...	7 oz.	" "	.024%

Probably the platinum exists in the ore as sperrylite, although this point was not proved. The amount of platinum in the mass most thoroughly examined would require to form sperrylite only about .007% of arsenic, which is too small a quantity for detection by ordinary analysis. That platinum should exist in appreciable quantities in an ore of such a character is something quite extraordinary, but whether it could be profitably extracted is an open question. Sperrylite was first found at the Vermilion mine in the gossan or loose material, and was named after Mr. Francis L. Sperry of the C. C. C. by Messrs. Horace L. Wells and S. L. Penfield, of the Sheffield Scientific School, who examined and described this new species. It is isometric; simple cubes are common, octahedrons are exceptional, while the majority of the crystals are combinations of the cube and octahedron. II.—Between six and seven, as it scratches felspar but not quartz. The crystals have no distinct cleavage, but are very brittle and break with an irregular, probably conchoidal fracture. The chemical composition, according to the mean of two analysis was as follows :—

Arsenic	40.98
Antimony	.50
Platinum	52.57
Rhodium	.72
Palladium	trace.
Cassiterite or oxide of tin	4.62

The composition is therefore represented by the formula Pt. As_2., a small portion of the platinum being replaced respectively by rhodium and antimony. The color of the mineral was nearly tin white or about the same as metallic platinum. The fine powder is black. Nearly all the grains showed extremely brilliant crystal faces, though most of the crystals were fragmentary in size they were usually $\frac{1}{50}$—$\frac{1}{500}$th of an inch in diameter. Sp. Gr. 10,602.

ROASTING.

The metallurgical treatment of this ore commences at the roast yard whither it is conveyed, and, being piled in convenient heaps on previously laid cordwood, is exposed at high temperatures without fusion, or, at most, incipient fusion, to the action of a current of air. The objects of this roasting are, 1st, an oxidation of the iron, and, incidentally, of the sulphur, as complete as is posssible without involving an undue loss of copper in the slags of the following smelting, and 2nd, the expulsion of arsenic if there is any present. If the oxidation be very imperfect the resulting matte will contain so much iron that its bringing forward will be unduly costly, while, if the oxidation be too thorough, an undue loss of metal will occur on smelting the roasted ore. At Copper Cliff the Canadian Copper Company have spared neither trouble nor expense in the construction and equipment of their roast yard. The natural rough and uneven surface has been cleared and levelled, and the whole given a gentle slope, which, with carefully made drains, serve to remove at once any rain or surface. These precautions have to be taken to prevent loss of copper as soluble sulphate of copper, which is liable to be washed out by the rain.

At the Murray mine a large shed has been erected to roast ore during the winter months, with openings in the roof to allow of the escape of sulphurous fumes, but during last summer they had no regular roast yard, and the few heaps burnt could only be placed where the surface of the ground would permit. This was also the case at the Blezard and Worthington mines, and the mechanical loss alone from this carelessness must have been of considerable moment. The shaft of the Copper Cliff mine, on an incline of 45°, has reached already a depth of nearly 600 feet. It is provided with a double skip road, the skips dumping automatically at the mouth of the breaker in the top of the rock house. Here the ore is sledged to a proper size for the 15 x 9 in. Blake crusher set to about 1¾ inches, which has a capacity of nearly 20 tons an hour. It is then passed through a revolving screen where it is sized into three classes for the succeeding operation of roasting. The coarse size passes a 4-inch ring, the medium or ragging, a 1¾-inch ring, while the fines pass through one ¾ of an inch in diameter. Each of these sizes falls into a separate bin under which a car runs. Thus the ore is loaded automatically into cars holding 1½ tons, whence it is transported to the upper story of the ore shed. There it falls into a series of bins from which it is loaded by means of inclined steel shutes into the cars and taken up a rather steep grade to a high trestle which extends the whole length of the roast yard. The only wood that can be obtained is dead pine, a good deal of the surrounding district having been burnt over about 20 years ago. This can be procured very cheaply, and although it does not roast the ores as thoroughly as hard wood, it makes very fair and economical fuel, and serves on account of its short fierce heat to ignite the pile, and this once started continues burning on account of its sulphur contents. These piles are built as follows:—The place selected is first covered with about six inches of fine ore distributed as evenly as possible over the clay soil. Sticks of cordwood of nearly uniform size should be placed side by side across both sides and ends of the rectangular area. The whole interior of this can be filled in with old stumps, roots, ties or cordwood, but in such a way as to form a level and solid bed for the ore to rest on. Over all this is placed small wood and chips to fill up all interstices, care being taken to provide small canals filled with kindlings at intervals of 8 or 10 feet leading from the outer air to the chimneys along the centre of the heap. These chimneys which assist in rapidly and certainly kindling the whole heap are usually built of four sticks or old boards, so fixed together as to leave an opening and communicating below with the draught passages. Five or six of these chimneys suffice for each pile, and they should project 2 feet above the upper surface of the heap, so that no pieces of ore could fall into the flue opening. The coarsest class of ore is first thrown on, then the ragging or medium, on top of which is scattered a layer of rotten wood or chips, and lastly the whole heap is covered over with fines till it reaches a height of about 6 feet. The whole structure should then form a shapely rectangular pile with sharp corners and as steeply sloping sides as the ore will naturally lie on without rolling (about 45°). Only a portion of the fine ore is put on at first, the rest being shovelled on after the fire is fairly started. The best way to light the pile is to place a quantity of ignited cotton waste saturated with coal oil down each of the chimneys. About 12 hours after firing, the whole heap should be pouring forth dense yellow fumes of sulphurous acid. Great attention is at first paid to the pile to prevent undue local heating which frequently causes partial fusion of the ore, and this can at once be prevented by covering the place with more fines. This heap should then burn from 50 to 70 days when the outer covering of raw or partially roasted ore is removed, and the remainder of the heap conveyed a few yards in wheelbarrows to a sunken railroad which runs alongside of the roast-yard. When filled, the cars are pushed up another steep grade along a track running over the bins back of the smelter. The sloping sides and corners of a pile are frequently covered with almost raw ore, this evil being often remedied by placing ignited sticks of cordwood around the whole structure, or by building a new pile in the passageway between two others which have been almost burnt out, the latter plan adding very materially to the capacity of the roast-yard. After this operation the ore is invariably so thoroughly roasted that it is necessary to add from 10 to 15% of raw fine ore during the smelting to prevent the matte from being too rich. Each pile usually contains about 600 tons of ore, and requires 30 cords of wood to roast it. The roast yard at Copper Cliff is nearly half a mile long by 100 feet wide, while each pile occupies a space of 40 x 80 feet, room being left to get round them, and for drains. The present capacity is about 60,000 tons, which, with a little extra work, could be increased to 90,000 tons. Working full power each roast-bed can be used four times a year, counting the time in making, roasting and clearing the beds. The yearly capacity would therefore be 240,000 tons, and by increasing the space, 360,000. The unroasted ore contains from 35 to 40% sulphur, and assays of a large number of samples of the roast heaps have varied from 2½ to 8% of sulphur. One analysis taken at random which may be taken as a fair sample of all the rest, gave 5.40% copper, 2.43% nickel 7.92% sulphur and 25% iron, lime, magnesia, etc., and the residue chiefly hornblende. Up to October 1st, 1890, 56,534 tons had been taken to the roast yard.

SMELTING OF THE ORE.

There are two smelting furnaces at Copper Cliff, and the building which contains these is 65 feet long by 40 feet wide. Thirty-five feet of this length is on a level with the ground, while the rest of the floor is 8½ feet higher, and it is on this upper flat that the ore and fuel bins are situated. The daily capacity of each of these furnaces is 125 tons, although one of the furnaces has reduced 187 tons of ore in one day, and the furnace manager says that 135 tons could be reduced without much forcing. The furnace itself is a steel plate water jacket of the Herreshoff patent, made in Sherbrooke, P.Q., by the Jenckes Machine Company. It is nearly oval in form, the longer diameter at the tuyères being 6 ft. 6 in., while the shorter one is 3 ft. 3 in. There are 11 2½ in. tuyères through which the blast enters from a Baker's rotary blower under a pressure of about 9 oz. per square inch. It is 9 feet high from these tuyères to the charging door, and is an unbroken water jacket from the cast iron bottom up. It is made of rolled steel with only a 2 inch water space, and not a single brick of any description. The well is a circular, cast iron water jacketed vessel, mounted on four strong wheels for convenience of moving it when repairs are necessary, and so made that the hole in one side connects with the outlet hole of the furnace, which is also thoroughly protected by water and it is through this that the matte and slag flow out of the furnace as rapidly as formed. They thus escape the influence of the blast, and prevent what Vivian calls "the sole objection to blast furnaces" the so-called "sows" or "salamanders" as great masses of metallic iron which choke up the furnace and tie up large quantities of copper and other metals. The charging door is situated on the upper floor, as also the bins for roast ore and coke. The coke used is from Connellsville, Pa., and is brought by way of the Great Lakes and the Sault Branch of the C. P. R. The charge for the furnace consists of 1,800 or 2,000 lbs. of ore and coke mixed, one ton of coke usually sufficing for eight tons of ore. The mass as it melts gathers at the bottom of the furnace, and flows through the outlet into the well or reservoir, where the heavier and metallic portions sink to the bottom while the lighter slag remains on the surface, running in a continuous stream over the jacketed spout into pots on wheels, which are removed when filled. an empty one always being ready to take the vacant place. The matte is drawn off at intervals of 15 or 20 minutes through a separated bronze water-cooled tap-hole casting, near the bottom of the well, and which is filled as usual with a clay plug that can readily be removed with a few blows from a steel bar. The smelting of the ores is greatly facilitated by the basic character of the accompanying gangue rock, for instead of quartz and acid silicates there is chiefly hornblende and very fusible felspars. This circumstance, as well as a judicious mixture of the different qualities of ore obviates the necessity of any flux, which is a very fortunate circumstance, as limestone is somewhat distant and suitable iron ore difficult to procure. The slag buggies or pots are made as strongly and lightly as possible, are case-hardened and shaped like inverted hollow cones, and before each tap are thickly washed with clay water to prevent the matte from welding to the iron mould. This matte is sampled and weighed and allowed to cool before being dumped from the pots and the slag also is sampled and assayed once every 24 hours, so that an accurate record can be kept of the composition of both. An average of two analyses of this matte in February and March, 1889, will probably give us the usual composition: Copper, 26.91; nickel, 14.14; iron, 31.335; sulphur, 26.95; cobalt, .935. Mr. F. L. Sperry says that platinum exists in quite appreciable quantities, so that the matte contains some ounces per ton of that rare metal, while gold and silver occur in strong traces. The first blast furnace was started on the 24th December, 1888, and with slight interruptions has been running ever since. The second furnace was built in the summer of 1889, and was started on the 4th of September of the same year. On October 1st, 1890, there was about 6,500 tons of matte, and the ore on the roast beds would produce about 6,000 tons more, containing 922 and 852 tons of nickel respectively, or a total of 1,774 tons of metallic nickel, and 3,362½ tons of metallic copper.

The average daily output of matte for the month of September, 1890, was 25 tons, but the full capacity of both furnaces would be about 60 tons of matte. If the former average was kept up, the yearly production of matte would reach 9,125 tons, but if the furnaces were run at their full capacity they would average nearly 8½ tons of nickel a day, or nearly 3,066 tons of metallic nickel and 5,913 tons of copper a year. At present the matte is piled in heaps outside of the smelters, and, when wanted to be shipped, is broken up in pieces and placed in old oil barrels, the chinks between the larger pieces being filled with smaller fragments, so that the whole is packed tolerably firm and close. It is then sent to the various refiners in Europe or the United States according to their respective bids. So far no refining works have been built at Sudbury, but the vast quantity of material to treat, the tedious and costly process for the further refining of the ore, consisting as it does of alternate roastings and smeltings, in addition to the great expense incurred at present in shipping the matte to such long distances, seem great incentives to the early erection of refining works, so that the ore could be fully treated on the spot The proposition to build nickel-steel works was lately submitted to the Government by the Canadian Copper Company, and it is to be hoped that some satisfactory arrangement will be arrived at to give a further impetus to our present mining activity in this region.

Nickel is a comparatively new metal, for it was not recognized as an element till 1751, when Cronstedt, the Swedish mineralogist, in examining the ores of certain veins in the German copper mines made the discovery of the two new metals, nickel and cobalt, which names he retained as they were n use amongst the miners. Nickel in its pure state is silver white in color, hard, tough, fusible with difficulty, and is susceptible to magnetism, although not to the same extent as iron.

Its use in the industrial arts has rapidly increased since it has been produced in a pure state, as it formerly existed only as an impure alloy, and so could not be so suitable for the purposes for which it is now used. The demand has only grown at a moderate rate as compared with the growth and demand for other useful metals, and a decrease in price from $2.60 per pound in 1876 to the present price, which varies from 50 to 60 cents per pound, seems to have had no very important influence in increasing that demand. The supply of late years has been more than sufficient for the demand and new deposits have always been found in advance of any necessity for their product. The first chief demand for this metal was for making nickel or german silver as a substitute for the more precious metal in making spoons and forks, and other ware in general for which silver had been previously used, and its whiteness and the facility with which it received and held the silver, after the process of what is known as electro-plating was introduced caused it to be still more widely used. It is also made use of to plate iron, zinc, &c., and also in alloy with copper for the manufacture of small coins, which are used so extensively in the United States, Germany, Belgium and other countries. The proposition to use rolled nickel plate as an advance over ordinary tin plate, is one which is receiving attention at present. It has also been recommended for making nickel crucibles to replace those of silver used in chemical manipulations as they would cost less and have the great advantage of melting at a higher temperature.

Nickel plated kitchen utensils are coming into general use as in Germany, and as it is well known that acids have a more or less solvent action on nickel, an investigation was undertaken which showed that 7½ grains of nickel could be taken into the stomach and repeated for a long time without any noticeably bad effects. There is thus no ground for uneasiness in the use of such utensils, especially if the same precautions are used as in the case of copper vessels, namely, thoroughly cleaning them and avoiding the storing of food in them. The proposition to use nickel in alloy with steel to increase the strength and quality of the latter, will, if carried out, increase the consumption very materially, and all have been eager to know the result of the recent experiments undertaken at the instigation of the United States Government. A French invention has effected the means of regulating the composition of such an alloy, and subsequent experiments in Glasgow revealed the fact that this alloy could be made in any good open hearth furnace working at a fairly high temperature as well as in the crucible. In obtaining a correct idea of the value or usefulness of alloys of nickel with iron or steel it should be borne in mind that the composition is complicated by manganese, carbon, silicon, sulphur and phosphorus, whose influence must be carefully watched, requiring a long series of experiments. A comparison of steel alloyed with 4.7% nickel raised the elastic limit from 16 up to 28 tons, and the breaking strain from 30 up to 40 tons, without impairing the elongation or contraction of area to any noticeable extent. A further gradual increase of hardness was noticed until 20% is reached, when a change takes place, and successive additions of nickel tend to make the steel softer and more ductile. The alloys polish well, and the color of the steel is lightened as the proportion of nickel increases. They do not corrode as readily as other steel. The 1% nickel steel welds fairly well, but this property lessens with each addition of nickel. It can, therefore, be seen that considerable advantage may be expected from these alloys, especially where the percentage of nickel is less than five.

The consumption of nickel and nickel alloy in the United States has increased from 294,000 pounds in 1880 to 421,000 pounds in 1888, while the total consumption of the world was estimated not to exceed 700 or 800 tons of the pure metal. The chief supply at present comes from New Caledonia, a penal colony of France (long. 165° E., S. lat. 22°). M. du Peloux states that the cost of production at this place could be so reduced that the company could sell at from 37 to 46 cents per pound, and yet have a good profit. Dr. Peters, in his evidence before the Ontario Mining Commission, stated that the Canadian Copper Company could sell it from 25 to 30 cents per pound with a handsome profit. A commission appointed by the United States Government to examine the probable quantity of nickel in the Sudbury district has given a very glowing report to their government. It is highly probable, however, as can be seen from the above figures that our mines could supply the whole demand, even if the other sources of supply did not produce anything. It has been decided by the United States Government to make use of nickel steel armour plates, and already the contract has been awarded so that there is every prospect of a brilliant future for this mining industry around Sudbury. In view of our immense deposits it will be necessary to increase its consumption in every possible direction.

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Iron Ore Concentration.—The Thomas ore washer is a form of trough-washer with two revolving shafts furnished with helically arranged teeth. The box is usually 25 feet long, 5 feet wide, and 2 feet deep. A rotary screen may be used at the lower end to rewash the tailings when the washer is inclined so as to run a considerable quantity of small ore through with them. The revolving shafts are preferably geared together and driven by a pinion on a countershaft which is driven by a belt from the engine. For a washer of the dimensions given above, 35 to 40 gallons of water per minute are required, and 12 to 15 horse-power. The capacity is 50 to 70 tons daily.

The Construction of Details for a Modern Lixiviation-Plant.*

By C. A. Stetefeldt, San Francisco.

(Continued from page 134.)

§ 5. APPARATUS FOR RAISING STOCK-SOLUTION TO THE STORAGE-TANKS.

Plunger-Pumps.—Pumps of the Knowles type, as made and kept in stock by manufacturers, are not durable in contact with hypo-sulphite solutions, none of the metals or their alloys resisting its corroding action. To make such pumps durable, valves, valve-seats and plungers should be made of hard rubber or glass. It is difficult to induce manufacturers to take such orders except at extravagant prices. The same objections apply to centrifugal and rotary pumps.

Pumps of the Koerting Type.—Such pumps must be made of material not affected by the solution. Their principal objection is the dilution of the solution by condensed steam.

The Geyser Pump.—If into a pipe, open at both ends, and immersed in a well, compressed air is introduced at the lower end, the solution in the pipe rises and is discharged, together with the air, at the upper end. The invention of this pump dates back several centuries, and it has recently received from Dr. Werner Siemens the appropriate name, "Geyser Pump." In the *Engineering and Mining Journal* of December 28, 1889, I have fully described it as Pohle's Air-Lift Pump, and, on the basis of the investigations of Messrs. Behr and Browne of San Francisco, recommended its introduction in lixiviation-works. After I had made actual working-plans, however, for its introduction, some disagreeable features presented themselves, so that its application for raising stock-solution was abandoned. The objections consisted principally in the necessity of sinking a well, 30 feet deep, for the submersion-pipe, and in supporting a vertical solution-pipe 85 feet high.

The Montejus System.—A Montejus is an iron tank from which a solution is raised through a pipe by admitting steam or compressed air above the solution. (For protection of the inside, see § 13.) With steam, the tank should be in the shape of a long cylinder of relatively small diameter, standing upright, to avoid condensation as much as possible. With compressed air as motive power, the shape of the tank is not material. It is then best to place it so that the axis of the cylinder is horizontal. One of the heads of the cylinder is put on with bolts and a gasket, so that the interior can be easily coated with an asphaltic compound.

These tanks have two openings: one at the bottom, through which the tank is filled and discharged by a three-way cock, connected with the pipes leading to the solution-sump and the storage-tank; one on the top, through which air escapes while the tank is filling, and steam or compressed air is introduced to elevate the solution, which changes are also effected by a three-way cock.

For works of large capacity, two Montejus are placed side by side below the solution-sumps, so that one is filling while the other is discharged. They should hold about 200 cubic feet. Convenient dimensions are: 4 feet diameter and 16 feet length, or 4½ feet diameter and 14 feet length, with solution-pipes from 3 to 4 inches diameter.

For large works, compressed air deserves decidedly the preference. The size of air compressor, which should give about 30 pounds pressure per square inch, is the same for a geyser-pump as for a Montejus of equal capacity.

Although the effect of compressed air is better if applied to a geyser-pump than to a Montejus, the difference plays no important part in economy, while the original outlay for installation is in favor of the latter.

§ 6. APPARATUS FOR INCREASING THE RATE OF LIXIVIATION.

Suction-Hose.—The means hitherto employed for increasing the rate of lixiviation have been to give the hose of the solution-outlet below the filter of the ore tank great length, and discharge the solution at considerable depth below the tank, taking care that the hose remains filled with solution, and creates a suction by the weight of the solution-column. This method is objectionable, not only because it is difficult to get rid of all the air below the filter, but also for the reason that the solution has to be raised again to the precipitating-tanks, unless a very steep mill-site permits their position much below the ore-tanks.

Pumps.—These are not recommended for reasons given in § 5.

Koerting Ejectors.—A Koerting ejector is effective provided it is not made of material liable to be corroded by the solution. The lead-lined ejectors, sold by A. Allen, New York, are not durable; even the platinum steam-nozzles wear out. Ejectors of porcelain, with hard rubber steam-nozzles, are manufactured by the Koerting Brothers, Hanover, Germany. The great objection to a Koerting ejector is, however, the dilution of the solution by condensed steam. The apparatus also acts intermittently, unless carefully regulated to meet the capacity of the filter.

Montejus.—The best effect is unquestionably produced by a Montejus. For this purpose the opening at the bottom is connected with a pipe through which, by a three-way cock, the solution either runs in from the hose at the bottom of the ore-tank, or is raised to the launders in communication with the precipitating-tanks. The outlet on top has a pipe with a three-way cock, through which compressed air can be introduced for raising the solution, or a suction is created by a Koerting vacuum-pump for filling the tank, or communication is shut off both from the air-compressor and vacuum-pump, provided the apparatus is idle. Only one Koerting vacuum-pump, producing a vacuum of 68 cm. quicksilver, is needed for a number of Montejus tanks, the latter being all in communication with a pipe, at the end of which the Koerting is placed.

These vacuum-pumps are best obtained from the Koerting Brothers, Hanover, Germany.

Necessarily, the operation of the apparatus is intermittent; but the discharge of the Montejus takes such a short time that this is not detrimental.

§ 7. APPARATUS FOR CIRCULATING EXTRA-SOLUTION.

In circulating extra-solution of standard composition, only a quantity is used sufficient to saturate the charge in the ore-tank, and this is allowed to filter repeatedly and continuously through the ore. As will readily be seen, the Montejus system cannot be used for this purpose. Here we must rely either upon a Koerting ejector, made of porcelain, or use the geyser-pump. Which of the two deserves the preference is doubtful, the geyser-pump being untried. Their respective advantages and disadvantages may be stated as follows:

With the Koerting there is risk of decomposing extra-solution with formation of sulphates and Cu_2S, the solution coming in contact with the hot steam, and of weakening the solution by dilution. The heating, however, is beneficial. Circulation is also quicker by material increase of the rate of lixiviation.

In the geyser-pump, the extra-solution comes in contact with air only whereby it may deteriorate through the conversion of the sodium hyposulphite into tetrathionate, but without affecting the cuprous hyposulphite. By this reaction, and by the evaporation of water, the extra-solution will gain in concentration. On the other hand, the solution will be reduced in temperature and circulation will be slower, because the rate of lixiviation will not be materially increased, even by taking the submersion-pipe as long as practicable. The original cost of installation, and the expense of running, would hardly enter into calculation. Only an actual comparative test can decide which apparatus is the better.

§ 8. FILTER-PRESS AND PRESS-TANK.

For lixiviation-mills of various capacities I recommend Johnson's filter-press, with 24 to 30 chambers, 15 to 18 inches diameter, without distance-rings and with closed delivery. Closed delivery obviates the necessity of having a sump below the press, the solution being at once raised to the main solution-sump.

If it is desirable to free the precipitates from adhering stock-solution, for reasons given in my paper on "Refining of Sulphides." a filter-press should be used in which the cakes can be washed after the chambers have been filled.

The chambers are of cast-iron, with a coating of asphalt varnish, which should be occasionally renewed.

The proper way of charging the filter-press is by a press-tank. In Mr. Daggett's paper (*Trans.*, xvi., 438), a press-tank is illustrated and described, constructed for steam-pressure. For works of large capacity, steam should be replaced by compressed air. In the latter case the wooden diaphragm and the pipe extending to the bottom are superfluous, and the precipitates are charged through an opening in the side of the tank near its top.

The construction, as shown in the cut, is not recommended. The bottom as well as the top should be made of boiler-iron or steel-sheet, not of cast-iron. At the Marsac mill, one of these tanks exploded, by breakage of the cast-iron bottom, at a pressure of 80 pounds. For compressed air the tank should be constructed to be safe for 150 pounds pressure to the square inch.

§ 9. DRYING-CHAMBER FOR PRECIPITATES.

A drying-chamber for sulphides and other precipitates, is illustrated in the paper just cited, pp. 440 and 443. Its construction is contrary to all rules for a good system of drying by hot air. A chamber of this kind, in use at the Marsac mill, has a very low efficiency. Correct principles of construction are to heat the air by a coil of steam-pipes in a separate chamber attached to the dryer, to allow the heated air to enter the drying-chamber at the top, and circulate downward between the iron pans charged with precipitates, and finally to withdraw the moist air at the bottom by a Koerting steam-jet ventilator. Upon these principles all modern apparatus for desiccation is constructed.

The outlet of the steam-pipe may be either connected with a steam-trap or with the mud-drum of the boiler. The latter can only be done if the boiler is so located that its mud-drum is lower than the outlet of the coil. In this case the coil works on the gravity principle, the most economical method of utilizing the heat of the steam. The coil should be tested for leakage at a pressure of 80 pounds.

§ 10. AUXILIARY MACHINERY.

Air-Compressors.—For Montejus or geyser-pumps and for the press-tank, two separate air-compressors are needed, the one furnishing air of about 30 pounds, the other of 150 pounds pressure. The size of the compressors must be calculated to meet the demands of the capacity of the works. The Montejus air-compressor should have a capacity to raise all the stock-solution needed per day in about 8 hours, so that the plant is not in operation all the time and the solution can be transferred quickly.

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*Trans. Am. Inst. of Mining Engineers.

Sulphide-Sampler.—The breaking up of the lumps of sulphides and other precipitates, as they come from the drying-chamber, is done in an ordinary small sample-grinder, as sold by any western foundry.

Boilers.—If considerable steam is needed for heating the stock solution and wash-water prior to its precipitation by scrap-iron; also for running Koerting ejectors and vacuum-pumps, a separate boiler is desirable for the lixiviation-plant proper.

Fire-Pumps for Sluicing Tailings.—If the water in the pipe-line has not sufficient head for sluicing tailings, a fire-pump for this purpose becomes necessary. A steam pump of the Knowles type may be used with 10-inch steam and 5-inch water-cylinder, 12-inch stroke and 4-inch suction and discharge. But I would recommend a Koerting steam-jet fire-pump, which is much cheaper than a plunger-pump and not less efficient.

§ 11. PIPE-LINES.

Iron gas-pipes are used for conveying stock-solution and sodium sulphide solution.

They should be joined by flange-couplings. The size of the stock-solution-pipes above the ore-tanks depends on the capacity of the works, and the position of the storage-tanks, producing more or less head. In large works they are generally taken from 3 to 4 inches diameter.

§ 12. COCKS.

The only cocks resisting for a long time the corroding action of lixiviation-solutions are the Pratt-Cady iron-body, Bower-Barffed plugs, asbestos-packed cocks, sold by Fairbanks & Co., New York. These cocks last very well, even on the sodium-sulphide mixing-tank. They were first introduced in lixiviation-works by the writer at the Marsac Mill, Park City, Utah.

§ 13. PROTECTION OF IRON BY ASPHALTIC COVERING, AND OTHER NOTES ON CONSTRUCTION.

Castings and Pipes.—Castings and pipes exposed to hyposulphite solutions must be protected by an asphaltic covering; the pipes, of course, on the inside. Pipes conveying sodium sulphide solution do not require such covering. A pure asphalt, called "Maltha," manufactured in San Francisco, the residue from distillation of heavy California mineral oils, now shipped in considerable quantities to the eastern States, is exceedingly well adapted to this purpose. The maltha is melted in a sheet-iron trough, and the clean and dry castings or pipes are immersed in the bath. They should remain there until the iron has reached the temperature of the liquid asphalt; this insures firm adhesion of the asphaltic covering to the iron. The propeller-screws and shafts for the precipitating-tanks are covered in the same way.

Montejus tanks and the press-tanks need different treatment. Here a malthine varnish is used. To the clean and dry inside of the vessels, a coat of varnish is applied. After drying, a second coat is put on, and, as the painting progresses, cotton cloth—weight about 6 ounces per yard—is pasted on, care being taken to saturate overlapping joints with varnish. On top of the tank the cloth is drawn over the flange. The cover is treated in the same way. Finally, a third coat of varnish is put over the cotton cloth. After perfect drying, the cover is bolted on, using a soft rope saturated with varnish for a gasket.

Fastening Castings and Flanges to Tanks by Bolts.—Bore holes to fit bolts close; countersink bolt-heads into wood and cover with thick white lead. Washers behind bolt-heads are also bedded in white lead. Bolts are first covered with asphalt.

Connecting Rubber Hose with Gas-Pipe Nipples.—The following method was communicated to me by F. M. Johnson: Draw out the nipple to fit the inside of the hose closely; heat the nipple so that it will melt rubber without burning it; then press the nipple into the hose about 4 inches and immerse immediately in asphalt varnish for cooling. The hose adheres so firmly to the iron that it can only be removed by cutting.

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Mineral Production of Great Britain.—The total quantity of mineral wrought in the different districts of the United Kingdom during 1890 was 194,605,887 tons, of which 181,614,288 was coal and 8,117,476 ironstone, the rest being fire-clay, oil shale, and other minerals, making a total increase of 4,972,231 tons compared with the preceding year. There was an increase of 4,697,564 tons of coal, but a decrease of 153,066 tons of ironstone. The ratios of the fatal accidents and the deaths to the number of persons employed in and about mines under the present and former Coal Mines Acts are given in averages for the periods covered by the first three Acts and in detail with averages since 1872. From these it appears that the occupation of the miner is now more than twice as safe as it was at the commencement of the Mining Acts, the average ratio under the first Act being one death in every 233 persons employed, under the second Act one death in 258, under the third Act one death in 312, under the fourth Act one death in 466, whilst for the present year it is one in 528—a much more favourable ratio. From the ratios of accidents and deaths to the number of persons employed and tons of mineral wrought in each of the districts a general average is obtained of 226,023 tons of mineral for every fatal accident, and only 167,763 tons for every death, as compared with the slightly less favourable quantity of 223,624 tons per fatal accident, and the considerably more favourable quantity of 178,227 tons per death in the preceding year.

Arsenic and Sulphur as Metallurgical Agents in the Treatment of Canadian Auriferous and Argentiferous Ores.*

By R. Dewar, Toronto.

We are all too well aware of the direful results on amalgamation caused by the presence, in the ore operated on, of arsenic, and more especially sulphur, as their capacity for neutralizing the mercury and thus rendering it useless to hold the gold or silver that passes over it, is very great. These troublesome elements are got rid of at the present time by roasting, but this causes expense, and metallurgists even hint at a loss of the precious metals by this treatment. I differ with them so far as to say, that if there is any loss, which there may be, the same is so minute that practically there is none.

The chlorination process, as it is variously applied according to the different patents granted for it, has a drawback in the treatment of these ores, in its restriction to those only in which the metals are in a state of fine division, therefore in ores like some of ours, in which the metals are in larger bodies, it is rendered useless; but in any case the ores must first be roasted to get rid of the arsenic and sulphur, as they form troublesome salts with the chlorine. Now, it is quite apparent that if part of the treatment could be dispensed with, it would be the means of increasing the returns in a great many mines at present in operation. Why then could we not dispense with the chlorination, and do the work with the roasting alone? It may seem impossible at first, as the roasting is merely a preliminary to the chlorination, which is the principal. There is a law of metallurgy which has been greatly neglected, and I may say has not been paid the attention or given the research due to it. That law expressed is that when a metal is alloyed with one or more of the other metals, the resultant alloy has a lower melting point than the mean of the several melting points of the constituents taken together. Let us take an example, for instance, an alloy of 1 part lead, 1 part tin, and 2 of bismuth: the melting point of lead is 325° C, tin 227·8° C, bismuth 259° C, their sum is 811, their mean 270° C. This will melt at 100° C, which is just 170° C below the mean. Is this not sufficient proof for this law? Let us take another example, that of an alloy of lead and platinum. Platinum does not melt even in the highest temperature obtainable in a blast furnace, but only in the flame of the oxyhydrogen blowpipe, and the calorific intensity of oxygen burned in hydrogen = 3,154° C. Now, if we take for granted that the heat absorbed by the nitrogen of the air is equal to the extra heat generated by the blast caused by the forcing of the gases through the nozzle, which consequently causes a more rapid combustion, hence a higher temperature, these figures represent the blow-pipe flames' temperature, hence the melting point of platinum. Those calculations of mine are not mathematically correct to the fraction of a degree or so, but are quite accurate enough for our purpose. Now the melting point of lead added to that of platinum = 3477, therefore the mean = 1739° C. I have melted such an alloy at 1000° C, that is 739° C below the mean; is this not a magnificent example? This law is confined to no special one, but holds good for all alloys.

Why, then, if this is a general law of all alloys, is it not applicable in the case of arsenic, sulphur, silver, and gold? You will object that arsenic and sulphur are not metals proper. That is quite true of the sulphur, but not so of the arsenic; but still that would not incapacitate them to form alloys with the metals. They may either be as a salt, such as a sulphide or arsenide, or be in molecular proportion to form chemical compounds, or in excess or deficient for such, and only form mechanical mixtures, or one contained in solution in another, or in an allotropic state; but still they are alloys, and in proof of this we have only to look at shot lead, which is an alloy of arsenic and lead; copper also alloys with arsenic as a greyish brittle metal; and has not galena the resemblance and properties of an alloy?

In consideration of this I hold that arsenic, sulphur, silver and gold do alloy, and that therefore the temperature at which they melt is lowered in virtue of their being alloyed with the sulphur and arsenic.

In accordance with this, we will now consider the following data:

As—melts at 220° C. We will say that, although it oxidises at that temperature, therefore its melting point must be lower.

S—melts at 115° C.

Au—melts at 1102° C.

Their sum is 1,437, their mean, 479° C; therefore this would seem to indicate the melting point of this alloy. This corresponds to a temperature below incipient red, as it is according to Powilett 525° C, dull red being 700° C. I do not mean to insinuate that gold alloyed with arsenic and sulphur will be reduced to such a ridiculously low melting point, but I do mean to say that it is lowered considerably, as I have melted them at about an incipient cherry red, corresponding to a temperature of about 800° C, and perhaps a few degrees lower, so that I can vouch for it as being correct. If the melting point of silver be added, namely, 1023° C, the sum will = 2460, the mean, 615° C. I may say I have melted them at such a temperature and below it.

Many of our ores carry sufficient S and As for this law to be taken advantage of in their treatment; but before we can see in what way it would be advantageous to us, we must consider another law. That is, namely, the spheroidal form given to small portions of metals or alloys under three different modes.

This is a law which none of the works as yet published on metallurgy have mentioned, and I don't think that any of our profession have paid any attention to it, and that some are even ignorant of its existence. We shall consider the modes under which this form is given.

1st. When metals in a thin body or sheet, such as gold-leaf, are exposed to certain temperatures the sheet breaks up and forms into globules. This may be proven by taking any gilded work, say for instance on wood, and placing it on the lid of a furnace or common stove. When the wood begins to char the gold will be seen to form into globules. This is caused directly by the heat.

2nd. When certain metals are alloyed with others, they cause a shrinkage concentrated to a certain spot, which acts as nucleus, around which another portion of the alloy forms a globule when cast upon a cold surface, into water, or when pressed from under or through a crust of part of the alloy solidified. This is caused, 1st, by one of the constituents cooling more quickly than the rest. 2nd, when one of the constituents has a greater shrinkage power than the other. We can again take shot lead into account. As I have said, it is an alloy of arsenic and lead. Arsenic is of nature a great shrinker or contractor, and thus it is used to give the rotund form to the lead, as it causes it to contract when it touches any solid body and form a ball. We may further prove this law by taking an alloy that is known to shrink: melt, and cast into an open mould, let the top solidify, strike it two or three gentle taps with a hammer or die, having a broad striking surface, when the metal will be seen to force its way up through the crust and form globules on the surface.

The third mode really belongs to the former two, but we will consider it as an independent one. It is the action of the atmospheric pressure in the promotion of a spherical form in molten metal, when in small quantities. It is the best known law of hydrostatics that a fluid will flow until it finds its level; but pour water on any highly heated surface, and instead of flowing until it finds its level and keeping in a body, it will break up into little globules, and either run about or stand still, until the atmosphere in its vicinity is cooled sufficiently, when it evaporates in steam.

The same may be said of the metals with a little modification; the surface will do as well if it is cold, and not so well if it is at too high a temperature, unless there be a good supply of cold air playing in on the surface; but it all depends on the melting point of the metal, and the rapidity with which it cools. On studying this, I have come to the conclusion, that the heat radiated from the metal or alloy heats the air in its vicinity; that by the law of gravitation, the heated air having expanded, and thus having a lower density than the cold air, ascends to make room for the same; that the rapidity with which it ascends partly breaks the equilibrium of the atmospheric pressure; that the pressure being less on the upper surface, it is inclined to rise, and thus partly kept from spreading or finding its level; that it is aided in this by a lateral pressure, if I may so express it, which is not disturbed by the ascension of the heated air. That this is true may be seen by a great many metals when cooled suddenly by artificial means, or not formed into globules until on the point of solidifying, they will be seen to have their tops (the globules) very much flattened. This shows at once that it is the exertion of the atmospheric pressure, as if they had been hot or not cooled so suddenly, their tops would not have been flattened. Why then could these laws not be applied in the metallurgical treatment of our gold and silver ores? The sulphur and arsenic would assist to lower the temperature at which they melt, by alloying with them, and any portion that did not combine with them would act as a flux. I need not extol the virtues of such a flux; it would collect any fine gold, and bring it in conjunction with more, forming a globule, while at the same time the sulphur would act as fuel and produce heat, the arsenic, according to its nature, would cause any body of metal it happened to be in to shrink, and form a globule, thus all the fine and leaf gold would be collected into bodies large enough to be easily worked, and this could be done by roasting, but not roasting as is practised at the present day, as arsenic and sulphur are considered a disadvantage, and it is to get rid of them that it is practiced. Allow me to quote a passage from Overman, the late American metallurgist, as it will show us the object of roasting as it exists. He says: "Roasting means to heat a metallic ore or matte to at least a red heat, or such a heat that the mineral does not melt, but only the volatile or combustible substances are expelled, and as much oxygen becomes combined at the same time with the ore as it possibly can absorb." But we are aware of the weak affinity of the precious metals for oxygen, they are therefore reduced direct to the metals. In accordance with this he says further on that "sulphuret of silver is easily liberated from its sulphur and forms metal; the same is true of gold."

Roasting was resorted to but very little in the treatment of ores of the precious metals until lately, and even where it is used the benefit that might accrue from it is lost by restraining the temperature from rising above a certain point for fear of sintering, and thus causing extra expense in the working of it.

Well, to go into detail of how I intend to roast these ores. They must either be roasted in piles or kilns. I prefer the pile as a larger portion of ore can be operated on at once and more easily manipulated than if in kilns, and there is also very little outlay in preparing the bed to receive the same; but it all depends on the metallurgist who is considering the question, as one man can see an advantage where another could not. I shall go no further into detail than to say that the pile will be merely the ordinary one, with special attention paid to its draught canals, which shall be two feet apart. We shall commence by building up the foundation from 18 in. to two ft. in height, of hardwood, the height it is to be built depending on the amount of sulphur contained in the ore; the more sulphur the less fuel, and *vice versa* for the other extreme. The top should be easily reached so that the fines that form the covering could be easily manipulated. When the pile is all ready for lighting, we shall light it at one end only, and not all round, as is usually done, as the fire will spread soon enough for our purpose. When the end is well lighted let it have the benefit of a full draught by opening four draught canals (two on each side), and clearing the fines at the top, for four feet, when the ore having this great draught will sinter; when it has pretty well sintered, turn three or four jets or streams of water on it. This will cause it to crack and crumble; then let men with long iron hooks pull the crumbling parts away, so that the water may the better get at the other parts, and keep continually clearing away, as it is possible to do so; when within one foot of that part of the pile, whose draught canals are not open, stop putting on water, open two on each side, pull fines off top as before, let sinter put on water, and pull and clear away as ready, repeating this until the pile is finished.

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*Trans. of the Canadian Institute.

The ore which has been done in the meantime is carried off to the mill and fed to the stamps; there may be sluices having hardwood riffles, leading from the mill to settling tanks, or it may be stamped dry, and the work of cleansing left to the buddles, but the wet way is to be recommended, as it will save a great deal of work in the buddles; the battery may be cleaned out every hour or a less period of time, according to the amount of ore that has accumulated in it and carried to the round buddles to be selected. All the gold and silver will be left in the battery, except, perhaps, those fine shots which may be ejected by the stroke of the stamps, and which will be intercepted by the hardwood riffles; as for the tailings, they will be found to contain practically nothing.

Naturally you will have come to the conclusion that the arsenic and sulphur which were alloyed with the gold and silver, will still remain with them and be troublesome impurities which can only be got rid of by refining, thus causing a further outlay of time and capital. This will depend principally on the temperature to which the ore has been exposed. If the temperature is only risen to that point at which the gold and silver melt, they certainly will contain these elements as an alloy, but if on the other hand, they are risen to that temperature which is obtainable in any roast pile, the gold and silver will be found free of even traces of these elements. In proof of this I shall make mention of an experiment by which I demonstrated it. I took ore known to contain both arsenic and sulphur, and divided it into two portions, which we shall call A and B. I raised A in temperature until the gold was seen to form on the surface in globules, and no higher. B I raised in temperature until it sintered. I afterwards made analysis of several of the globules from each portion; in A I found both arsenic and sulphur, and in further proof of my statement that arsenic and gold alloy, I found it (the arsenic) in the metallic state. I do believe that this could not have been confirmed more conclusively than by the finding of the metallic arsenic present. In the several globules from B, I found neither arsenic nor sulphur, thus showing that the high temperature to which the ore had been exposed had oxidized them.

The oxidization is accomplished as follows: The extreme heat of the roast pile when sintering, sets the sulphur and arsenic on fire, producing arsenical and sulphur fumes; the arsenical fumes combine with the oxygen of the air, forming arsenious acid $As.\ O_3$, of the old nomenclature, or arsenious anhydride of the new, $As_2\ O_3$, and with the sulphur as sulphur dioxide, or sulphurous anhydride $S.\ O_2$, and also combine together to form the sulphides, the orange realgar $As.\ S_2$, and the yellow orpiment $As.\ S_3$. I found the former predominated. Also when the water is thrown on the ore it helps greatly the oxidization of these elements, and clears away almost all traces of them.

Now allow me to draw your attention to the advantages to be derived from this process. In the first place you must all be aware that the matrix of an ore, it matters not whether it be quartz, calc-spar, or any other mineral, when heated to redness and either suddenly immersed in water, or water thrown over it, will be rendered quite brittle, and will fall to pieces with the least concussion or blow, and even with some the disintegration is so great that they will break up during their immersion, or while the water is being thrown over them.

Now, this would be a source of great and general economy. The stamping expenses would be reduced; for instead of each stamp doing one ton per diem, they would do five tons; five days' work would be done in one; consequently saving five days' tear and wear of plant, also five days' steam and fuel, besides five days' wages to the workmen and other items of which I shall make no mention, unless to say that the returns would be quicker, thus making it a point of great importance.

I am of the opinion that many men of our profession are ignorant of the cause of the loss of a portion, if not all of the gold and silver in an ore, by assay when treated by the amalgamation process, and which they call free gold, and which appears so to the eye, but in reality is covered with a thin film of sulphur, which renders it impervious to the mercury to form an amalgam. It seems strange this has never been discovered before, but my father and I have proved it to be true, and were intending to publish a paper on it, but were anticipated by Mr. Skey, analytical chemist for the New Zealand Geological Survey, who published a paper on this subject under the title of "The Absorption of Sulphur by Gold and its effects in Retarding Amalgamation." Now, this sulphur can be got rid of by roasting at the proper temperature, and as to expenditure, have I not shown the advantage in less labor and mechanical power being required in the further treatment of these ores?

Another cause of great loss is the carrying away by water of the float gold. The cause of its floating is that, although it has the highest specific gravity, or density of all the metals except platinum, iridium, and osmium, which are 21·50, 21.15, and 21.4 respectively, gold being 19·50, and thus almost twenty times heavier than water, it has such a great surface in comparison to its weight that the water resists its sinking, and also the hydrodynamical force of the water in carrying it away even was it inclined to sink, keeps it in suspension and prevents it from doing so; thus it is carried over the amalgamated riffle plates and lost. Now, had the ore containing this fine gold been treated according to the process I have described, the fine and leaf gold would have been converted into globules, and even were the globules only the size of a pin's point they are bound to sink, as their surfaces are not to be compared with their density, and the water cannot resist them; they will all either remain in the battery or on the riffles, as they are too heavy to be carried away hydro-dynamically. Then there is the great loss of mercury by neutralization by the arsenic and sulphur, which I before mentioned, and also those ores the matrix of which consists of calcium carbonate, cause enormous loss of mercury, as it is absorbed by the mercury, and causes it to be spongy and light, and to be carried away by the water more easily than the fine gold itself. Now, the amalgamation process can be dispensed with in this treatment, thus avoiding the above named loss.

As regards the presence of lead or any other of the baser metals in the ore to be treated, the lead would alloy and assist to collect the gold or silver; as to zinc, antimony or others, they would be completely oxidized.

In conclusion, I would lay special stress on the point that all ores should be selected, and not as is at present done, all rushed through as they come and by the same process, but arranged systematically and treated accordingly.

A Sinking Machine and a New System of Sinking Pits.

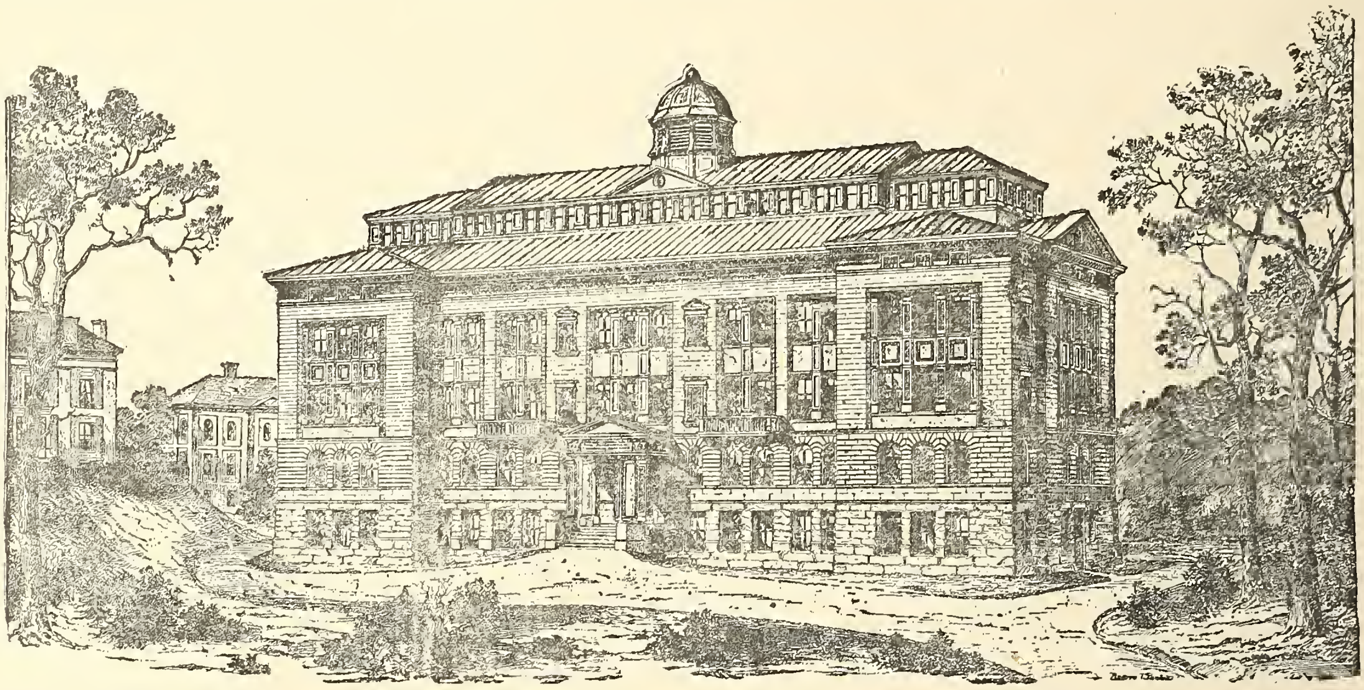
At the last meeting of the session of the Manchester Geological Society, a paper under the above title was read by Mr. Richard Sutcliffe, M.E., of Huddersfield :—

Seeing that a number of colliery owners in different parts of the country proposed sinking new pits, most of which were intended to reach a very considerable depth, and therefore must occupy a long period of time before winning the coal, he began to study and enquire to see if there was no means of improving upon the slow method of sinking as at present prevails, and he came to the conclusion that it was quite easy to devise a more speedy, safe, and cheaper system by the adoption of machinery instead of hand labour, and by replacing the present practice of sinking in the middle of the pit, by what he thought to be a more rational mode of cutting-out and setting free the layers of strata all around the pit bottom in advance of the sinking. To accomplish this he had designed and patented a machine which could be worked by means of compressed air, electricity or such other motive power as the user might decide to adopt, but he preferred the former (compressed air) on account of its cooling effects on the pit bottom, as well as its general utility in a mine. The machine consisted of a frame of steel or iron girders, firmly secured together with angle brackets at the centre, and cross girders at one end to carry bearings, which took the driving shaft. Four shoes were fitted one at each end to the girders, and allowed to slide freely on the same to the extent of 2 or 3 in., and having a flange at each side of the webs of the girders. Brackets were also secured to the sides of the girders near the ends, and these brackets contained two flanges each, between which flanges a nut was fitted, and worked by means of a ratchet, and in these flanges were suitable holes through which a screw passed, and was coupled to the shoe at each end of the girders. The air engines or their equivalents were fixed on the girders so as to gear into the cog wheel, which was keyed on the shaft, as was also the pinion, which meshed or geared into an annular rack and rotated it when the engines were set in motion. The size of the engine cylinders was about 8 in. by 12 in. An annular rack composed of four or more pieces for convenience in handling, and with which was cast a vertical flange or shroud about 2 ft. deep and 1 in. thick, to take girders and their strengthening stays. To the underside of the girders were secured four strong brackets, one at each end, fitted with journals which carried runners, upon which runners the annular rack travelled, carrying with it the whole of the under portion of the machine, a cutting barrel or cylinder composed of eight segmental steel castings, four of which were extended upwards to take slides which worked within the girders, and also the pistons of hydraulics. On the under end of the cutting barrel were cast tool boxes or sockets, to hold cutting tools, and on the internal side of the barrel were spirally-placed ribs at frequent intervals, which served to keep the annular channel clear of broken earth or *debris* by scooping out the material, and they also assisted to preserve the rotundity of the barrel by strengthening it. Also for the latter purpose an internal flange was placed at the top of these ribs, and four hydraulics for the purpose of regulating the feed and withdrawing the cutting barrel from the groove cut, or to lower the girders and their connections for a fresh cut. When the machine was being made ready for a cut, the girders were securely and firmly fixed in a horizontal position by pressing the shoes, which were packed with wood to increase friction and absorb vibration, against the sides of the pit by means of the screws and nuts, care being taken that a small space was left between the annular ring in order that the weight might be lifted off the cutting pieces before starting the machine, and when working it should be allowed to feed as it cuts. When out to their full extent the shoes should be released from the pit sides and the upper portion allowed to descend, either by means of the hydraulic or the capstan rope, on which the whole machine might hang. Small flexible tubes were conveyed from a small plunger and fixed at the engine to the hydraulics, so as to be able to work them from the engine when desirable instead of by hand. The girders in this machine were arranged to allow two sinking buckets to pass, one on each side, but where it was desirable to have only one sinking rope near the centre of the pit, the girders could be placed parallel and kept sufficiently apart. Assuming this machine to have twenty single and twenty double cutting pieces acting at the same time in the groove and making one revolution per minute in the pit bottom, it should cut at least 30 in. per hour in ordinary sinking stone, and with the stone set free all around layer after layer could be filed away without any powder. Sheet iron shields were allowed to hang from the stationary girders to protect the workmen from the rotating portion of the machine. When it was necessary to cut a walling bed, special cutters were secured to the machine, and these cutters expanded outwardly as the cutting barrel descended from the annular rack. Mr. Sutcliffe next proceeded to describe his new method of sinking. In order to expedite the raising of the sinking material he used guide ropes, and in the following manner: Suspended on four guide ropes were two parallel beams of timber tied together at each end by iron plates, in which were fixed four set screws, which pressed against the sides of the pit in order to steady the guide ropes and beams in their proper position. On these beams were secured flooring deals so as to cover the whole of the pit except the openings required for the sinking buckets, air pipes, etc., in order to facilitate working thereon and to afford additional protection to the sinkers underneath to that supplied by the special walling scaffold to be used in putting in the walling simultaneously with the sinking. For the walling or lining of the shaft he employed concrete, and to do so he placed on the flooring deals above referred to a temporary walling crib composed of iron or steel and made in four pieces or segments, which were connected together by four bolts or screws and nuts with suitable brackets as shown. The top of this temporary walling crib was placed on a level with the wall bed or annular step, and there expanded by the screws or bolts and nuts until made securely fast from pressure against the sides of the pit. When segments of wood were placed upon it in order to facilitate the closing of the next lift below to be afterwards put in underneath a course ot bricks or blocks with quick-setting cement, or a low course of rich concrete was next set partly resting on the annular step cut for walling bed, and partly on the temporary walling crib. On the inner side of the wood packing was next placed a circular course of casing composed of angle iron-frames, lined with corrugated sheet iron having the undulations placed horizontally in eight segments of a height of 3 feet bolted together and having a wood packing piece in one vertical joint to facilitate the withdrawal of the same. The freshly-made concrete was poured in behind this casing, taking care that it was properly placed and packed all round by a careful hand and suitable utensils, and when filled and packed to the top another course of casing was placed on the first and filled in at the back with concrete in like manner, and so on placing course upon course and filling them with concrete at the back until the bottom of the lift of lining or walling above is reached and closed up to. When the lift of walling to be put in was a long one, the annular steps might be cut at intervals of from eight to twelve yards, so as to distribute the weight of the walling on the surrounding strata for extra security, instead of allowing it to rest entirely on the material composing the lining of the pit. It would be at once seen that a short time sufficed to allow the withdrawal of the temporary walling crib, when it could be lowered with the guide ropes and reset for another lift of walling, leaving the corrugated casings above, secured by the undulations in the lining, until required for the fresh lift, when they could be brought down and reset at the same time as sinking proceeded. In conclusion, he might say he expected and believed that six yards per day of three shifts could be sunk and lined as safely and as easily as the amount now attained in ordinary sinking.

Low Tension Shot Firing.—At a meeting of the North Staffordshire Mining Institute at Stoke-on-Trent, Mr. W. Heath presiding, Mr. T. M. Winstanley Wallis, of Derby, read a paper on "The Low Tension System of Shot Firing." He observed that the means of firing explosives used in mines were for all practical purposes limited to the time fuse and the electric fuse. There were two systems of electric shot firing, which he described, and he stated his reasons for preferring the low tension rather than the high tension system. By far the best method when an electric light or power circuit was within reach was to fire the fuses from the wires in the same way as from a battery, thus obviating the necessity of a battery or exploder.

A Canadian School of Mines—Description of the New Buildings of the Faculty of Applied Science, McGill University, Montreal.

In view of the many letters that have appeared in the press and the resolutions passed by the various societies of mining and scientific men, calling for a School of Mines, the present sketch of the new buildings devoted to this and kindred pursuits by the Faculty of Applied Science of the University of McGill at Montreal, will be of especial interest. Mining engineering and geology have for a long time been embraced in the curriculum of this Faculty, and although the facilities for instruction have been most inadequate, yet very many successful mining engineers, metallurgists and assayers have been sent out, and not only these, but men who have taken a high place in original scientific research. The number of geologists, also, whose education was obtained at McGill, is large, and among them are many prominent names. With such men as Sir William Dawson, Dr. B. J. Harrington and Mr. F. D. Adams in charge, the character of the instruction provided is assured to be of a high standard. The record of the past should be eclipsed in the future, however, for with the new buildings now almost ready for occupation, McGill is put on a par with other schools of mining and other engineering, and will doubtless attract many students who would otherwise have gone to Europe or the United States for a technical course. It is to the liberality of Mr. W. C. McDonald, of Montreal, that the University is indebted for this most useful addition. The McDonald Technical Building has been provided and in great part fitted up by him, though other gentlemen have presented the Faculty with many of the necessary machines and appliances. There are nine laboratories in the building :—

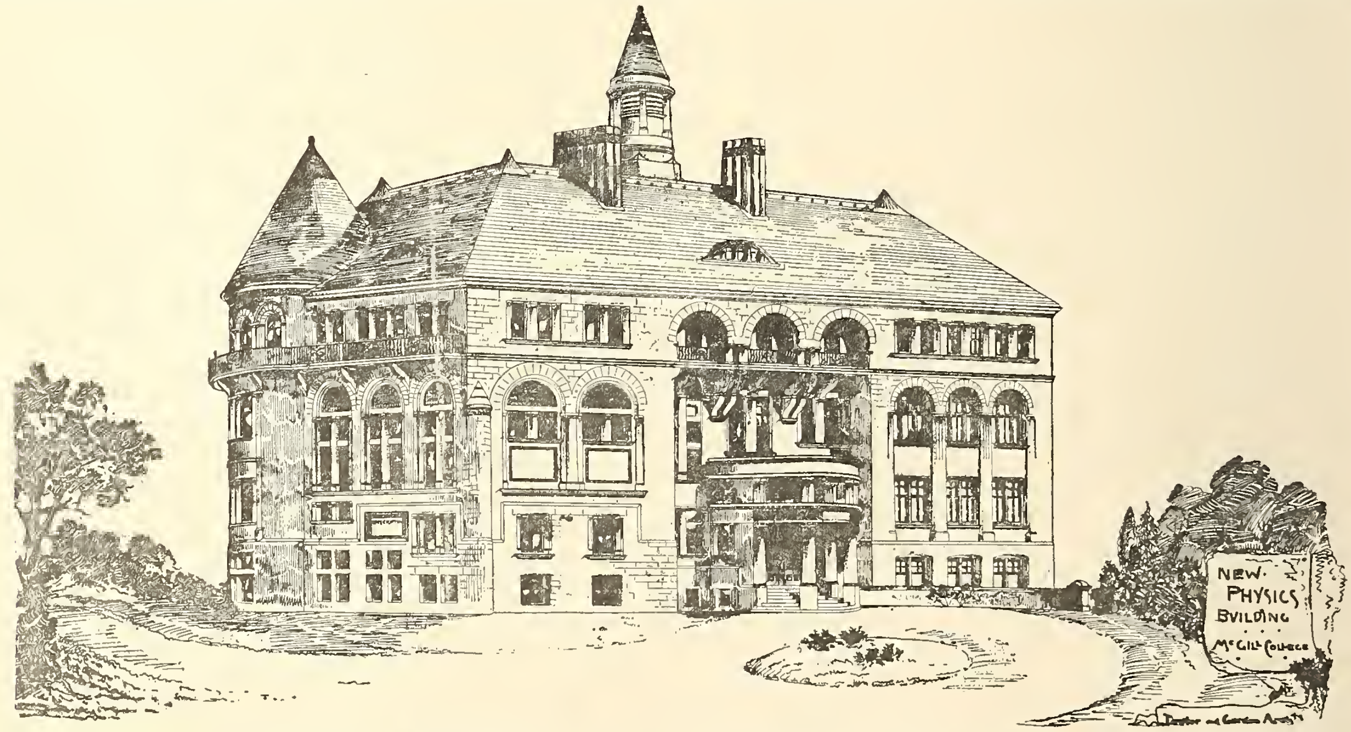


THE M'DONALD TECHNICAL BUILDING.

Nos. 1 and 2. Testing Laboratories.—These are equipped with a 100-ton Wicksteed and a 75-ton Emery machine for testing the tensile, compressive and tranverse strength of materials. For the former an addition has been especially contrived whereby the transverse strength of timbers up to 25 feet in length can be determined. The Emery machine is constructed and graduated with such accuracy as to render possible delicate experiments in elasticity. The laboratories are also provided with an autographic torsion machine, for ascertaining the torsional strength of materials, and there are besides many other appliances too numerous to mention.

No. 3. An Hydraulic Laboratory.—In this the student will study practically the flow of water through orifices of various forms and sizes, submerged openings, over weirs, through pipes, mouth pieces, etc. Suitably designed tanks are provided for the purpose, and there are also turbines, hydraulic motors, etc.

No. 4. A Cement Testing Laboratory.—This laboratory is fully equipped with the necessary apparatus for making tests of cement.



Nos. 5 and 6. Thermo-dynamic Laboratories.—An experimental steam engine of 80 h. p. has been furnished for this laboratory, and four cylinders, so connected as to allow of single, double, triple or quadruple expansion, condensing or non-condensing, etc., besides many other appliances.

Nos. 7 and 8. Electrical Laboratories.—Are fitted up with dynamos and engines of several types, besides instruments for making electrical measurements, etc., and are in every respect complete and well equipped.

No. 9. Metrological Laboratory—This contains absolute standards of length up to 100 feet, and instruments for graduating standards of length, etc.

One large drawing-room occupies the whole of the fourth storey, covering an area of nearly 9,000 square feet, and is lighted from the roof. The course in drawing includes freehand and model drawing, descriptive geometry and topographical drawing, the preparation of the drawings of parts of machines and other structures, and finally, complete machine and structural designs.

Another fine building, the McDonald Physics Building, illustrated in this issue, is now in course of erection on the University grounds. It will be fully equipped with laboratories and apparatus for the study of experimental physics, and will be available for the use of students in the Faculty of Applied Science.

In keeping with the greater facilities thus offered, the Faculty of Applied Science has been divided into five departments, viz : civil engineering and surveying, mining engineering, mechanical engineering, electrical engineering and practical chemistry. The course in each extends over four years and is designed to afford a thorough training both of a theoretical and practical character. Full courses of lectures are given in mathematics, chemistry, mining, surveying, physics, mechanism, zoology, geology, applied mechanics, thermo-dynamics, hydraulics, geodesy, mineralogy, metallurgy, assaying, electrical engineering, and also in modern languages. In the department of mining engineering the work includes such of the civil and mechanical engineering course as is essential to the education of a mining engineer. A thorough training is provided for in geology and mineralogy, and in order to give a practical character to the work frequent geological excursions are made and numerous minerals and rocks are determined and analyzed in the laboratory. In the lectures special attention is devoted to the economic aspects of geology.

Work in the chemical laboratory is begun in the first year and continued throughout the course, mainly consisting of assaying by the dry, wet and electrolytic methods. In the third year a special course of lectures on mining is given. It is illustrated by diagrams and models, and includes the discussion of blasting, quarrying, hydraulic mining, boring; special methods of exploitation employed in the working of metalliferous deposits and coal seams, ventilation of mines, pumping, etc. In the fourth year the lectures on metallurgy are illustrated by diagrams, models, and collections of ores and metallurgical products. An additional lecturer on mining will be appointed in time for the next session.

Students are expected to spend their summer vacations in practical mining operations or field surveys, and to present reports in the ensuing sessions.

As yet there is no special mining laboratory in which practical operations in ore-dressing, etc., might be carried on, but it is hoped that this deficiency will be supplied in the near future. Following is the curriculum of subjects taken up in each of the four years of the course:—

FIRST YEAR.

Arithmetic, Euclid.
Algebra, Trigonometry
Geometrical Conics.
Solid Geometry.
Descriptive Geometry. (By permission of the Faculty)
Freehand Drawing.
Chemistry.
Sanitation.
English.
French or German.

SECOND YEAR.

Practical Chemistry.
Mechanism.
Surveying.
Descriptive Geometry.
Algebra.
Analytical Geometry.
Calculus.
Mathematical Physics.
Experimental Physics.
Zoology.
English.
French or German.

THIRD YEAR.

Theory of Structures.
Materials.
Mining.
Practical Chemistry.
Blowpipe Analysis.
Descriptive Geometry.
Analytical Geometry.
Calculus.
Mathematical Physics.
Experimental Physics.
Geology and Mineralogy.
Modern Languages.

FOURTH YEAR.

Assaying.
Mathematics.
Metallurgy.
Geology (advanced.)
Mineralogy (advanced.)
Heat and Heat-Engines.
Hydraulics.
Materials.
Designs.
Estimates. Specimens.
Modern Languages.

LEGAL.

The Emerald Phosphate Company v. The Anglo-Continental Guano Works Co.

This case was tried in the Superior Court at Aylmer before Mr. Justice Malhiot. The action was brought to restrain the plaintiff from alleged trespass on defendant's property, and a preliminary injunction was granted by the Court while the case was in progress. Judgment was rendered on June 3, in favor of the plaintiff. The following is an excerpt from its text:—

The plaintiff alleges that it is in possession of lot 19 in the 12th range of the Township of Buckingham, and that defendant is in possession of lot 18B in the same range and township; and that the possession of the two parties dates from 1874 is admitted. It is proved that E. W. Murray took possession of lot 19 in 1875. His possession was aggressive; it was made as openly as possible. He drove the agents of the Buckingham Mining Company from the lot *vi et armis*. No more public possession could be desired. After him came Mrs. Murray, Allan, Paige, The Ottawa Phosphate Mining Company, S. P. Franchot and the Emerald Phosphate Company, who according to the evidence of McIntosh, Franchot, Henwood, Stuart, and others, retained possession of lot 19 up to a line marked out by George C. Rainboth in November, 1875.

After Rainboth's survey in 1875, Murray, then owner of lot 19, considered that those who owned lot 18B were trespassing below the surface upon his lot. The Buckingham Mining Company then owned 18B. He went down into their pit accompanied by George C. Rainboth, his surveyor, who certified that those working lot 18B had already trespassed upon lot 19 to the extent of six inches. The opening through which this encroachment was made is known as the *Grant Pit*. Upon the occasion of his visit, Mr. Murray warned the foreman of the Buckingham Mining Company that he should go no further west. The foreman, Dickson, then stopped his westerly operations.

No operations seem to have been done on lot 18B from the time when Murray warned Dickson in 1875 up to 1887 when Mr. McIntyre who had bonded the property of 18B seems to have had a survey made by Edward J. Rainboth. This survey was *ex parte*. The owners of No. 19 were not called upon to take part in it. This survey was not an act of possession. From 1875 to 1890 no claim seems to have been made by defendant or its predecessors beyond the George C. Rainboth line of 1875. Mr. Isbester who purchased 18B at a sale by the sheriff of the lands of the Buckingham Mining Company says he never knew of the G. C. Rainboth line of 1875; but his foreman, Dickson, knew of it; and Mr. McIntyre, who may have walked over the lots in question during his leisure moments, does not establish any possession in favor of himself or those to whom he sold.

There was no dispute of the G. C. Rainboth line during the occupancy of Murray, Allan, Paige, The Ottawa Phosphate Mining Company, Franchot, or of the Emerald Phosphate Company until the arrival of J. Burley Smith.

Mr. Smith knew the line of division was in dispute. His protest of August is, however, a retractation of his protest of June, 1890. Instead of adopting the proper proceedings to have a boundary defined, Mr. Smith seems to have been desirous of taking the law into his own hands.

When he comes into court, the pleas he fyles on behalf of his company do not correspond with his own testimony. He pleads that no phosphate was ever taken by his company from lot 19. This is an equivocation. He then pleads that no delimitation line had ever been drawn between the lots. This plea condemns defendant. Why should it despoil the land in dispute which is proved to be most valuable of all its worth without taking steps to have the line determined? The court does not wish to say anything further than that Mr. Smith's pleas and his evidence do not agree.

It is in evidence that Murray held possession of the lot 19 up to the G. C. Rainboth line, and that the owners of the same lot, under the chain of title which is admitted to be correct, have held up to the same line since 1875.

Our law of injunctions is wider than that of England. No one who has not had possession during a year of a piece of land can enter upon it without being met with a writ of injunction if the possessor chooses to use the writ.

No proof of possession during a year by defendant has been adduced. E. J. Rainboth's survey in 1887 was not followed up by possession. As surveyor, he had a right to go upon the property.

Plaintiff and defendant have both requested leave to amend their procedure. Leave is granted in each case. As to the petition for contempt against defendant, the court cannot allow it, inasmuch as Mr. Smith seems to have ignored the nature of the writ, but his company must pay costs as work was actually carried on after the writ was served.

The injunction is made permanent with costs until a proper division line is fixed either by the Court or by amicable agreement.

This report of the judgment was received from Mr. T. P. Foran, plaintiff's solicitor. Since then we have been handed another *verbatim* report by Hon. Mr. Laflamme, Q.C., who was retained by the defendants. This differs in several important points from the above, and as we confess we cannot tell which is the genuine article, we present the second one also, leaving the decision to our readers' judgment.

The Court having heard the parties by their counsel upon the merits, firstly of the defendant's petition for suspension of the injunction, secondly, upon the plea to the form, thirdly, upon the merits of the injunction, and fourthly, upon the merits of plaintiff's motion to have defendant fined for contempt of this court for disobedience to the injunction given to defendant in this case:

Having examined the proceedings and heard the evidence in open court,

Considering that it is proved that defendant continued to extract phosphate on the land in dispute after service of the writ of injunction herein issued and notwithstanding the order to the contrary in said writ, but that it appears from defendant's answer to said motion and the affidavit of William Burley Smith, defendant's manager, that the said works were not done in contempt of the order of this court, but from misunderstanding and that as soon as defendant's manager, Smith, knew the nature of the injunction the defendant immediately obeyed it,

Doth dismiss the said motion but with costs thereof against the defendant.

And adjudicating upon the plea to the form:

Considering that amongst other reasons therein mentioned the defendant alleges that plaintiff is a foreign corporation not having its principal office in the town of Buckingham, but in the State of New York, in the United States of America, and that this is proved,

Considering, however, that plaintiff has obtained permission to amend the writ and proceedings upon this point on payment of the costs of an exception to the form and that the writ and proceedings have been accordingly amended;

Considering that the other grounds of the said plea to the form are unfounded,

Doth dismiss the said plea without costs.

And adjudicating at the same time upon the plaintiff's injunction and upon defendant's petition for suspension of the injunction;

Considering that it is proved that plaintiff and defendant worked a phosphate deposit which exists upon the lot number nineteen (19), and on the south half of number eighteen (18), in the 12th Range of Buckingham, the plaintiff working on lot No. 19, and the defendant on the south half of lot No. 18, and that the plaintiff pretends that its lands extend to a boundary line drawn by George C. Rainboth, surveyor, on or about the 4th November, 1885, to divide the said lots;

Whereas defendant does not admit said line and pretends that its line extends beyond it to the west way and that it has the right to extract phosphate for a certain distance beyond the said lines;

Considering that it is admitted that plaintiff's predecessors owned and occupied lot No. 19 since the year 1874, and that defendant and its predecessors owned and possessed since the same date the south half of lot No. 18;

Considering that the said lots of lands are contiguous and that in November, 1875, Edward William Murray, then in possession as owner of the south half of lot No. 19 had a line drawn by George C. Rainboth, surveyor, to divide the said lot No. 19 from the said lot No. 18; that the said line was marked by posts on clear ground and by blazed places on trees in the bush land; that the said line was drawn in presence of the owner of the south half of lot No. 18, who at that time made no objection to the line and even assisted in drawing it;

Considering that subsequently, to wit, in the same year or the next year the said George C. Rainboth at the request of and in company with the same Edward Murray descended into the shaft on lot No. 18, known as the Grant pit, to verify if the Buckingham Mining Company, then owner of mining rights on lot No. 18, and working the said mine, was not trespassing upon the south half of lot No. 19, of which the said Edward Murray was in possession, by going beyond the said line drawn by the said George C. Rainboth in his subterrannean excavation in the Grant pit and that said George C. Rainboth after having made the necessary measurements established that the said company had gone about 6 inches across the line, and that the said Murray then stopped the employees of the said Buckingham Mining Company from working in a westerly direction; namely, in the direction of lot No. 19, and that in fact the said Buckingham Mining Company ceased working in said direction and directed its operations eastwards, and that it does not appear that the said Buckingham Mining Company have trespassed to the west of said line thereafter in mining phosphate in the Grant pit;

Considering that some time before George C. Rainboth had drawn the said line and measured the said shaft the said Buckingham Mining Company had been in possession of the said lot No. 19, and had extracted phosphate upon it and had been stopped from so doing by the said Edward William Murray;

Considering that there has been a well defined possession over to said boundary by the said Edward Murray and that this possession by the said Edward William Murray should avail his successors and assigns, and that it is proved that the Ottawa Phosphate Mining Company and afterwards Stanislaus Pascal Franchot, and afterwards the plaintiff, who succeeded one another as owners of lot No. 19, always possessed up to the line drawn by George C. Rainboth in 1875;

Considering that a year or two after the said George C. Rainboth had drawn the said line the said Buckingham Mining Company went into liquidation and ceased to exist, and that the mines on said lot No. 18 ceased to be worked until Defendant commenced to work them in March or April, 1890, and during all this time, namely during about twelve years, there does not appear to have been any effective act of possession done by the proprietor of lot No. 18, West of the said line drawn by the said George C. Rainboth;

Considering that the line drawn by Edward J. Rainboth in 1888 at the request of Alexander Fraser McIntyre, defendant's predecessor, having been drawn without the knowledge of the owners of lot No. 19, and without their participation cannot be considered an act of a nature to interrupt the possession of the plaintiff and its predecessors; that the latter continued until the institution of this proceeding in possession of lot No. 19 over to the said line drawn by the said George C. Rainboth in 1875;

Considering that on the 4th of June, 1890, the defendant, through J. B. A. Baudin, notary, notified the plaintiff that there was no boundary line between the said lots, and called upon it to appoint a surveyor to proceed with the surveyor appointed by the defendant, namely, the said Edward J. Rainboth, to draw the boundary line between the said lots of land;

That the defendant named Richard W. Farley, of Hull, its surveyor, to carry out the said *bornage*, and that the said surveyors could not agree upon the boundary to be given;

Considering that it is proved that in March last, before the issue of the injunction in this case, defendant in working its phosphate mine on the south half of lot No. 18 went about 6 feet in said Grant pit beyond the said line drawn by George C. Rainboth in 1885 towards the west and trespassed to that extent upon the land of plaintiff, being said lot No. 19, and mined and extracted phosphate therefrom;

Considering that the extent of ground in dispute between the parties in this case, and of which the plaintiff is in possession, is about in the middle of the phosphate deposit on the said lots, and that this deposit constitutes the sole value of the lots;

Considering that plaintiff is right in asking to be maintained in possession of the said lot No. 19 to the said line drawn by the said George C. Rainboth, at least until a boundary should have been established legally by the parties voluntarily or by a judgment of this court, and in demanding that defendant be enjoined to stop all the works to the West of the said line, and to stop removing phosphate from the West of the said line;

That the plaintiff's petition to this end is well founded, and that defendant's petition for suspension of injunction is unfounded;

Doth dismiss the latter petition and declare the injunction issued in this case good and valid; doth again order and enjoin the defendant to abstain from working or causing any work to be done upon said lot No. 19 as divided from said lot No. 18 by the said line drawn by the said George C. Rainboth on or about the Eighteenth of November, one thousand eight hundred and seventy-five, and refrain from taking out any phosphate of lime from the west of the said line so long as a boundary line between the said lots shall not have been determined either by the parties voluntarily or under judgment of this court or until it shall have been otherwise ordered by this court; the whole under all penalities of law;

Doth condemn the defendant to pay the costs of these presents which are granted to T. P. Foran, Esquire, attorney for plaintiff.

Defendants have appealed from this verdict, and it was understood that the case would come before the Court of Appeals on the 23rd inst., but on further consideration they have decided to bring it before the Court of Queen's Bench, where it will be argued in September before a full bench.

Johnson's Asbestos Co. (Ltd.) v. Bell's Asbestos Co. (Ltd.)

This action has been taken in order to obtain a judicial settlement of the boundary line between the properties of these companies. The amount involved is not definitely known, as it depends upon the value and amount of the asbestos in the strip of land under dispute, but it is possible that $25,000 would not cover the value. The case is under advisement before Mr. Justice Plamondon at Arthabaskaville, P.Q. No judgment has yet been rendered. Hon. G. Irvine, Q.C., is retained by the plaintiffs, and Messrs. Camirand, Hurd & Fraser of Sherbrooke, by the defendants.

Criminal Prosecution of Wellington Strikers.

At the Assize Court at Victoria, B.C., last month, the case of Bates and the fourteen union miners' charged with conspiracy was taken up by the grand jury. Judge Drake in addressing the jury explained to them the law in the case. He said all the trouble arose from the unfortunate strike there in progress; unfortunate, because by it many men were prevented from earning their bread by the act of the miners' union. The strike was not unlawful, but if the strikers had sought to compel others to come out or cease from work, then the bounds set by law had been overstepped. The union had claimed that the right of free contract was the basis of all freedom, but yet the union had followed a course directly contrary to the principle of free contract. The tyranny of the union was of the nature that its members would be the first to resist were it directed towards themselves. The unionists did not wish any outside the union to enjoy the freedom of contract. In the case of the Wellington miners, the evidence showed that a serious breach of the peace had only been prevented by the self-control and good sense of the non-unionists. The grand jury, after considering the matter, reported that they stood eight for a true bill and seven for no bill. The court decided that this amounted to no bill, and the accused were in consequence discharged.

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Phosphate Shipments.

The following are the official returns of the quantities of Canadian phosphates shipped to Europe from the port of Montreal since the opening of navigation to date :—

Date	Name of Ship.	Destination.	Shippers.	Tons.
May 9	SS. Charrington.	Bristol.	Lomer Rohr & Co.	75
9	do	do	Millar & Co.	30
16	" Pickhuben.	Hamburg.	Lomer Rohr & Co.	50
23	" Cynthiana.	Newcastle.	do	75
27	" Canopus.	Liverpool.	Wilson & Green.	500
29	" Steinhoft.	Hamburg.	Lomer Rohr & Co.	280
June 3	" Lake Winnipeg.	Liverpool.	Irwin Hopper & Co.	205
3	" Ripon City.	do	Lomer Rohr & Co.	350
6	" Athens.	Hull.	do	200
8	" Toronto.	Liverpool.	do	305
9	" F'lsof Inversnaid	Sharpness.	do	250
11	" Gothenburg City	W. Hartlepool	do	180
11	do	do	Millar & Co.	120
11	do	Newcastle.	Lomer Rohr & Co.	180
15	' Bushmills.	London.	do	200
15	do	do	Millar & Co:	200
16	" City of Lincoln.	Liverpool.	Wilson & Green.	605
17	" Naples	W. Hartlepool	Lomer Rohr.	350
18	" Sarnia.	Liverpool.	do	100
18	Barque Jan Melchers	Bristol.	Wilson & Green.	189
23	SS. Sarnia.	Liverpool.	Lomer Rohr & Co.	100
				4544

SHIPPERS' RECAPITULATION.

	Tons.
Lomer Rohr & Co.	2695
Wilson & Green	1294
Millar & Co.	350
Irwin Hopper & Co	205
Total shipments to date	4544

RECAPITULATION OF EXPORTS.

	Tons.
Bristol	294
Hamburg	330
Newcastle	255
Liverpool	2165
Sharpness	250
London	400
West Hartlepool	650
Hull	200
Total tons exported	4544

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Copper in Coal.—The blue coloration which is evident when salt is thrown upon ignited coal is traced by Salet to the presence of traces of copper. He shows that copper is usually present in minute quantities in the ash derived from coal.

MINING NOTES.

[From Our Own Correspondents.]

Nova Scotia.

Pictou County.

Operations in the Six-foot seam at the Vale have again been greatly interrupted by water; another new pump has been put in, but even yet the operators are going to have all they can do to keep the water down.

At their East River mine the Messrs. Muir & Sons are doing better this summer than they have done since starting.

The Foord pit has been put in thorough repair with brick and stone arches. The levels running north and south have been arched with brick two feet thick packed on top with sand with steel supports for a distance of some 300 feet. This completely isolates the old workings.

The coke-ovens built here turned out 5,000 tons of coke last month. This amount will be largely increased, for the production owing to repairs and other work has been much interfered with.

The Douglas slope is now in good working order. A tunnel has been driven across the measures cutting the large pit seam, and another to the four-foot seam where eighteen inches of Cannel coal has been opened. With three good seams this mine is, therefore, most favorably situated, and will produce largely. A vein of iron-ore, reported on analysis to carry 50% of metallic iron, has recently been found in these workings.

The Macgregor pit is working along much in the usual style.

At the Drummond colliery three levels in the lower lift are now being driven; these are down 4,000 feet, and the quality of the coal is undoubtedly improving at depth. The new engines are not quite ready yet for work.

The Acadia is working away as usual, never in a rush, but always giving a good account of itself. New hoisting-engine working very satisfactorily.

Cumberland County.

The Chignecto colliery is idle.

The Springhill collieries are in full blast, yielding their usual large outputs.

The coal at the Lawson mine is improving to the dip.

Patrick & Minudie mines, idle.

Work at the Joggins continues steady. Mr. Baird has overcome many difficulties, and is making longwall working a great success, materially increasing the production at a reduction in cost, while the men are making better wages all round than formerly.

Operations at the mines of the New Glasgow Coal, Iron and Railway Co., have not been carried on so briskly as during the summer of 1890, the attention of the company being devoted to the construction of the railway, 10 miles in length, and the blast furnaces at Eureka, both of which are now under active construction. The furnace will produce 100 tons of pig iron a day. An improved pattern of coke ovens is being constructed, capable of producing the coke required at the furnaces. Mining operations have never been entirely suspended, two gangs of men having been kept on development work at Bridgeville and Black Rock, and the ore still continues to stand the test of development. An issue of 8% preference stock has been made, almost all of which is subscribed for, and is considered an excellent investment.

GOLD MINING SUPPLIES.

The principal depot in Nova Scotia, carrying the most complete assortment of first-class goods, is

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Our line comprises Explosives, Fuse, American and English Mill and Hammer Steel, Bar and Bolt Iron, Steel Wire Hoisting Rope, Hemp and Manilla Rope, Rubber and Leather Belting, Miners' Candles, Oils and Lamps, Miners' Tools, Machinists' Tools, Blacksmiths' Tools, and every requisite for the gold miner.

H. H. FULLER & CO.,
Halifax, N.S.

The Board of Examiners met in Stellarton on June 10 to adjudicate on the papers of the several candidates who had appeared before the several divisions of the Board. There were twenty one candidates in all, seven from Cumberland, six Pictou, and seven Cape Breton. Of the number two only were successful in capturing Underground Managers' certificates, viz: Frank W. Crawford and Joseph Quigley of Westville; and one an Overman's certificate, viz: A. D. Ferguson of Spring Hill. The papers were very difficult, which perhaps, accounts for so large a number having failed.

Halifax County.

The next monthly meeting of the Gold Miners' Association will be held at Waverley on Saturday, 4th prox. at 10 a.m. Teams will meet the morning trains from Halifax and Truro at Windsor Junction. Trains will also leave Dartmouth at 9 a.m. for the accommodation of members wishing to drive to Waverley. Each member may bring one guest. Lunch will be provided. From the Review's personal acquaintance with the hospitality of the good folks in this district it can safely predict a good time for all the members of the Association who can take in this meeting.

Quebec.

Eastern Townships.

The Scottish Canadian Asbestos Company have some 45 men working on their Black Lake properties, and the results so far are reported most satisfactory.

Mr. T. A. Poston, Provincial Revenue Inspector, has been through this district lately and has declared himself perfectly satisfied that the powder magazines at the various mines conform to the requirements of the law. We are curious to know if his report is meant to cover that standing menace to the safety of the community, the magazine of the Bell's Company at Thetford village?

Dr. James Reed, Reedsdale, is reported to have sold his properties in Range A, Coleraine, to a strong French syndicate represented by Mr. O. Ladureau, who is now in the district.

The recent destructive fire at Black Lake demolished the store-shed at the railway owned by the American Asbestos Company; some 150 tons of the mineral in the building at the time was considerably damaged.

Messrs. King Bros. have put in a crushing and fibreizing plant at their mines.

Advices from the Jeffrey Asbestos Mines at Richmond, under date of 22nd June, report an output during the past three days of twenty tons of excellent grade; this is all the more creditable when it is considered that the whole work has been done here with but the crudest machinery. The output of all grades for 1890 was in the neighborhood of 800 tons. Mr. Jeffrey has decided to put in two new steam hoists (Copeland & Bacon), pneumatic drills, and other suitable plant.

Lievres River.

Ths Anglo-Continental Guano Works Company has its new steam scow the "Squaw" in full running order. A new saw-mill is also being built on the river bank. Work at the mines goes on steadily and a fair output is maintained almost entirely from the "Ætna" which is reported to be doing very well at depth. The Appeal in the injunction suit with the Emerald will be heard in Montreal in September.

The Dominion Phosphate Company of London shut down their mine at the Rapids at the end of May. The production was not up to expectations.

The Spruce Lake Mine is being worked steadily with a force of eight men, and is turning out a fair proportion of high grade ore.

Mr. Hayes of Gatineau Point, is continuing the development of the new mining lots lately opened at Notre Dame de Salet. About 30 tons of phosphate have been hauled to the river bank.

At the North Star Mine, the Dominion Company recently overhauled their steam plant, and put it into repair. They have started up again, and Capt. Williams reports that they have come into fresh paying ground.

Mr. Reid, Superintendent at the Ross Mountain Mine, has been obliged to shut down the steam pits on top of the hill for want of water for the boilers owing to the dry season. This has been compensated for by good results on the new openings on the east or river side. Fifty-three men are steadily employed.

Work at the General Phosphate Corporation's property High Falls is chiefly confined to three steam pits on the southeast flank of the High Falls Hill. A force of 75 men is employed, and the output, although not so plentiful as could be desired, is of very high test. In consequence of the delay in the determination of the improvement of navigation in the Long Rapids, the production of this mine can only be run through these rapids at the time of high floods, and, in the present state of the river, must await the spring of '92 for shipment.

The contract work for the locks at the Little Rapids is being pushed on energetically, the masonry work being handled with skill and economy. The low water in the Lievres is again making the necessity of these locks to be felt. The ascent of scows has been much hampered by the breaking down of the steam boiler of the winding winch, and the burning of the steamer "Eva" has been another source of irregularity in the river transport.

Mr. Jacob Weart, President of the Graphite Lubricating Company, Jersey City, N.J., has equipped his plumbago property in this district with a first class plant, including Krom rolls, concentrators and jigs.

Mr. Walter W. Pickford, who has been manager of the Phosphate of Lime Company's mines at High Rock, has resigned, having left for Florida during the end of last month. He has been succeeded by Mr. A. P. Twidell, who, by the way, THE REVEIW heartily congratulates on his recent marriage. At present 170 men are employed, and the production from the various pits, particularly No. 11, No. 19 and Cap Rock, is very satisfactory. About 1200 tons have been shipped since opening of navigation. A rumor is current that the General Phosphate Corporation has the purchase of these mines under consideration.

Very little work is being done on the Union property owned by the Canadian Phosphate Company; present developments are chiefly confined to the Crown Hill pits.

Superintendent Gilchrist is to be congratulated upon the very efficient and creditable plant in operation at Central Lake. 1000 tons were hauled from the mine during the winter.

Templeton District.

The Murphy property of the General Phosphate Corporation has shown a falling off in the original Bonanza pit, but new openings commenced at the north-east end of the property are turning out phosphate and promise well. Mr. Hector McRae has this year undertaken a contract to put down a number of test holes with the diamond drill, the results of which will furnish valuable information as to the future value of this property. Forty-three men are now employed.

The old Post mine in the east half of lot 9, 10th Range, is being worked by Mr. C. B. Falardeau, with a force of about 25 men. Present operations are chiefly confined to a long cutting called No. 19. It is operated by a steam plant and is now showing rich and abundant ground.

On the Jackson Rae mines on the west half of lot 9, operated by Mr. Thos. Fee, the pit at the old cobbing house has been suspended on account of water. Work is confined to the old pit in the north-west corner of the property. About 8 men are at work with a steam plant.

The Blackburn mine continues to lead in the regularity of its outputs. Mr. Lomer is confident that not less than 700 tons will be taken out this month with a force of 110 men.

Ontario.

Kingston District.

The Foxton mine is producing about 150 tons per month with a force of 30 to 40 men employed. 1,000 tons have been already shipped this year from the property.

The Kingston Mining Co.'s output averages from 100 to 150 tons. 400 tons taken out this year to date.

Capt. Boyd Smith has some 2,500 tons of phosphate ready for shipment from his Blessington mines.

Perth District.

The Anglo Canadian Phosphate Co. has resumed, and is enlarging, its operations at Otty Lake since the return of Capt. Adams from England. 30 men are now working. Several of the pits at last reports were looking very well and yielding satisfactorily.

The Bob's Lake mines, owned by this company, are being worked under contract. Latest advices report the discovery of some promising new 'shows.'

British Columbia.

Following are the foreign coal shipments of the different collieries for the month of May:—

	Tons.
New Vancouver Coal Co.	35,452
Wellington collieries	15,952
East Wellington collieries	975

The Glen Iron Mining Co. have ordered an ærial wire rope tramway for their mine at Cherry Creek. When the machinery is in position, it will take out from two to three hundred tons of ore per day, from the works to the spur of the railroad—a fall of about 400 feet.

The Building for the Whitewater Mining Company's mill has been completed and is pronounced a first-class structure of the kind. The machinery for the mill was placed on the cars at Nelson and run down to the Whitewater company's platform, opposite Ward's crossing. It will be packed thence to the mill-site by Wilson and Perdue's train. The mine is said to be looking well, and Mr. Goepel of Victoria, who is an owner in the property, says he hopes to see the Whitewater sending out gold bullion within 60 days. The company have put in a platform and chute opposite Ward's hotel and have acquired that property along with the ferry from the Wards.

Mining is being vigorously prosecuted on the Bonanza, and on Marshall & William's ledge. Hydraulic operations are progressing on the Vancouver Enterprise and the Lillooet Hydraulic, both of which are doing well.

Work has been commenced on waggon roads in both Toad Mountain and Hot Springs districts. The road in the latter district is under the superintendence of A. M. Wilson. It commences at the United mine and will run to the Number One, thence toward the Skyline. This route gives general satisfaction. In Toad Mountain District, work was resumed where it was left off last fall. Winslow Hall is superintendent, with "Bob" Yuill and "Dan" Dunn as foremen. Over sixty men are already employed, and the number will be increased from time to time. Cutting the right-of-way has reached a point about 4 miles from Nelson.

Indications seem to point to the Kootenai District as about to enter upon a new and greater era of development. The extensive prospecting now being carried on, will undoubtedly result in the discovery of deposits of ore not now known, and that there are large quantities of minerals in the Kootenai district is certain. Whether many of the leads now being worked are true fissure veins is doubtful, but that some are and others will be discovered is beyond question. It only needs one or two mines upon well defined veins of a certain thickness the mineral in which will pay a fair profit on the working cost, to start a movement which will surprise those who have no knowledge of the history of the great mining camps on this continent. It only required the Stevens and Iron mines in California gulch to start the rush to Leadville in 1878, and if current reports are true, there are some lodes already discovered in Kootenai which surpass in magnitude even that in the Robert E. Lee mine at Leadville.

The Gordon Hydraulic Mining Company, the incorporation of which is noted in our Companies column, has been organized to work some valuable placer diggings in the Leach River district. Mr. James Bennett of Port Angeles who was the chief promoter, is chairman, and Mr. J. B. Jones vice-chairman, Messrs. Garesche, Green & Co., being the bankers and treasurers of the company. The company has a grant of 480 acres on the Leach River, about 35 miles from Victoria. It is all very rich placer, and shows from 10 to 20 colors to the pan, while at the bed rock the ore shows plenty of coarse heavy gold. The Beacon Bar Hill claim is included in the property. Mr. Roper, one of the directors, has been mining there since 1884, and is satisfied that the diggings are very rich, and only require capital to make them pay heavy returns. It was through his experience and judgment that the necessary capital was advanced to develop the claims.

An electric plant will, it is understood, be installed shortly in the mines of the New Vancouver Coal Co. It will be a combination electric light, power and drill generator, with a capacity for coal cutters and electric percussion drills. The Edison General Electric Co. have also contracted to put down an electric tramway plant to be operated in No. 1 mine on levels 1 and 3. It is intended to replace the mules at present in use and consists of two 30 H.P. and one 15 H.P. Electric Locomotives. These motors will obtain their power from an 80 H.P. Edison generator. When complete there will be three miles of electrically equipped track in the mine. The steam power will be supplied by a 130 H.P. Leonard Ball high pressure engine. The whole plant is to be in operation within seventy days from the signing of the contract, and will cost about $25,000. This will be the first electrical tramway in the Province.

The Union Colliery Company of Comox have equipped their mines with a complete electric mining plant, purchased from the Jeffrey Manufacturing Co. of Columbus, O., consisting of one automatic engine, one dynamo with electrical instruments, copper wire, and four electric coal-mining machines. The plant has been installed and is now in operation, and is reported as working very well.

Steel Supports in Mines.—Mr. H. W. Hughes, in the *Journal of the British Society of Mining Students*, gives his experience with the use of steel supports in mines. For bars up to 7 feet in length a section measuring 5 by 4 by ½ inches, weighing 66 lbs. per yard is used. They cost 9s. 3¼d. each, and replaced oak bars measuring 6½ inches quarter girth and costing 2s. 8d. Before definite results were obtained, the mine fired. After a lapse of nine months the mine was reopened, and it was found that the steel bars had scarcely suffered, while the timbers were much broken. Twelve foot bars weighing 78 lbs. per yard, and costing £1 0s. 11½d. each, are also used to replace timber 9 inches quarter girth and costing 9s. In many cases the steel bars outlasted three to four sets of timber. In one place these bars lasted thirteen weeks, whilst oak bars never lasted more than a fortnight. Where there is a heavy weight, or in return air-ways, steel bars have great advantages. They should be set carefully with an equal level bearing on both props and roof. When they take a permanent set, they should be turned over or straightened. With these precautions the author has not had a breakage.

CANADIAN COMPANIES.

The Alberta and British Columbia Exploration Company (Ltd.)—This company has been incorporated under the British Columbia Act (Registration of foreign companies) to develop the resources of any lands by planting, clearing or mining, to subscribe out of the funds of the company towards any purpose likely to improve or benefit such properties, together with other powers for attaining similar purposes, such as the procuring of foreign capital to develop mines, &c. Head office, 21 Bastion street, Victoria. Capital stock £20,000, in 200 shares of £100 each.

The Sudbury Nickel Company (Ltd.)—This company has been incorporated under Ontario laws to carry on the business of exploring for, mining, refining, and selling nickel, lead, silver, gold, copper, and other ores and metals; and with other powers. Head office, Toronto. Capital stock, $50,000 in 1,000 shares of $50. Those incorporated are J. Wright, G. S. Crawford, W. M. Richards, A. B. Cameron, W. L. McK. Lindsey, all of Toronto.

The Nickel-Steel Company of Ontario.—This company is applying for incorporation under Ontario laws for the purpose of exploring for, mining, treating smelting, amalgamating and manufacturing copper, gold, iron, nickel, lead, silver and other ores, minerals, &c.; to acquire, construct and operate crushing mills, blast furnaces, amalgamating and reduction works and other plant; to sink artesian wells, and produce petroleum, salt and natural gas; to deal in lumber, develop electric or other power, and to carry on a general forwarding business. Operations to be carried on in the Districts of Algoma and Manitoulin and elsewhere in Ontario. Head office, Toronto. Capital stock $1,000,000 in 2,000 shares of $500 each. Applicants, R. L. Gibson, W. J. Fenton, A. Baillie, S. M. Flynn, M. G. Cameron, F. A. Fenton, Toronto, and Jacob Reese, Philadelphia, all of whom are to be the first directors. Solicitors, Ross, Cameron and McAndrew.

New Vancouver Coal Mining and Land Company (Ltd.)—At the general meeting of the New Vancouver Coal Mining and Land Company (Limited) held on Tuesday, May 26, at the Company's offices, 12, Old Jewry Chambers, E.C., the report and accounts for the year ended 31st December, 1890, were approved and adopted, and a dividend at the rate of 6 per cent. per annum was declared, payable 10th June.

The Gordon Hydraulic Mining Company.—This company has been organized under the British Columbia Act to work certain placer diggings in the Leach River district. The capital stock of the company is $50,000, divided into 50,000 shares of the value of $1 each. The directors for the first year are James Bennett, of Port Angeles, president, and Fred. S. Roper, John Boyd Jones, William Gordon Stevenson and John R. Stewart, of Victoria.

The Stadacona Silver-Copper Mining Company (Ltd.)—Application for incorporation under British Columbia laws, will be made by the above company, to take over an agreement made between the applicants and certain other parties for the purchase of the "Grizzly Bear Mining Claim," on Toad Mountain, Kootenai Division; also to carry on the business of smelters, refiners, founders, assayers, etc., to carry on the business of miners, and mine and work ores and minerals, etc., and crush, wash smelt and amalgamate their own or other ores; to do a general commercial business except banking and insurance, together with all other powers. Head office, Victoria, B.C. Capital stock, $100,000 in 100,000 shares of $1 each. Applicants, J. E. Ross, Spokane, Wash., P. C. Dunlevy, T. F. Sinclair, W. H. Ellis, T. S. Milligan, C. T. Dupont, J. Grant, J. Irving and S. O'Brien, all of Victoria. The first trustees are, P. C. Dunlevy, C. T. Dupont, J. Grant, J. Irving and C. D. Rand.

Intercolonial Coal Mining Company.—At a meeting of the Board of the Intercolonial Coal Mining Company, held on the 24th inst., Mr. J. P. Cleghorn was elected president and Mr. R. B. Angus a director of the company.

Toronto Mining Association (Ltd.)—This association, the incorporation of which we noticed some time ago, has been organized for the purpose of establishing in Toronto a centre of information on all matters pertaining to mining, from prospecting onwards, and a place where specimens may be received and examined, and such work done in connection therewith as may be required by prospectors. It is intended to collect in the rooms of the Association specimens of all merchantable Canadian minerals, with full particulars as to the place of deposit and as full additional information from a mercantile as well as a scientific point of view as can be had. The Association will also act as an agent in bringing forward schemes requiring capital, after necessary investigation by mining engineers and analysts. The capital is $3,000, in 300 shares of $10 each, and the membership fee has been placed at $4 for shareholders and $5 for non-shareholders. The secretary of the association is Mr. J. S. Lockie, 59 Yonge street, Toronto.

General Phosphate Corporation (Ltd.)—Subscription lists were opened in London on Tuesday, 9th June, for an issue of £100,000 in six per cent. debentures of £100 each, to be paid off at par on 1st June, 1896. It will be remembered that this Corporation was Registered just a year ago with the object of acquiring and developing phosphate lands in Canada and elsewhere. Of the authorised capital of one million pounds sterling some 16,598 shares or £195,980 sterling were allotted, but it appears that but a small portion only, £39,196 or £2 per share has been called up to date. The High Falls and Ross Mountain properties, situated on the Lievres River, in the County of Ottawa, Province of Quebec, were acquired at a cost of £95,000, and a contract entered into with one of the vendors, Mr. George Stewart, of Ottawa, by which he guaranteed an output of 10,000 tons of high grade mineral (*i.e.* from 70 to 80%) before 1st May, 1892, the cost of mining and transport to wharf in Montreal being limited to $9.00 per ton. At the hour of going to press we have not learned whether the debentures have been taken up by the public.

Eastern Development Company (Ltd).—At a meeting of the Privy Council on May 8 last, the privilege of crossing the Cape Breton Railway was conceded to this company, to enable them to carry the ores from the Coxheath copper mines to tidewater on the north-east arm of Sydney Harbour; the manner of crossing to be left with the Chief Engineer of Railways, Mr. Schreiber. Last week General Manager Gragg, with counsel, had a hearing before the Chief Engineer. The Government had an underneath crossing plan prepared, and the company one of a grade crossing, and after some discussion the latter was adopted, thus saving the company some $10,000. The Company's plan for extensive smelting works on Sydney Harbor adjacent to the abundant supply of coal there, is regarded as of importance to that section of the country, and is likely to receive governmental aid in some form or another.

The New Glasgow Iron, Coal and Railway Co. (Ltd.)—An issue of 5,000 8 per cent. preference shares of this company, cumulative after July 1, 1892, is now being offered to the public. The capital thus raised is to be devoted to the completion of a blast furnace and of a railway 12½ miles long to connect the iron and lime deposits of the East River with the Intercolonial Railway at the furnace site. The blast furnace will, it is estimated, produce about 20,000 tons of pig iron per year, at a cost of $10 per ton, and which can be sold at $17 per ton, thus making a profit of $140,000. Besides this, there is a bounty of $2 per ton of 2,000 lbs. on pig iron, which would add over $44,000 to the profits of the company. The shares are being offered at $55, or a discount of 45 per cent. Over 4,000 have already been subscribed for and allotted. The contract for the railway has been let to Messrs. McIntosh & McGregor, two good local men, who are pushing it, and are to have it ready for the rails before December 31. The construction of the furnace is also being advanced as rapidly as possible; the plates for the shell are now on their way out from Glasgow, and the company expect to be making pig iron before March 31, 1892. The ore deposits are being further developed, and continue to give great satisfaction. Mr. H. Graham, New Glasgow, N.S., is the secretary of the company.

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Latest Stock Quotations of Canadian Companies in England.

	Price.	
Excelsior Copper, Limited, £410,738 fully-paid shares of £1	——	
Nicola, Limited, £35,000 fully-paid shares of £1	——	
Shuniah Weachu, Limited, £99,888 fully-paid shares of £1	——	
Silver Wolverine, Limited, £68,465 fully-paid shares of £1	——	
Tilt Cove Copper, Limited, £160,000 fully-paid shares of £2	——	
Ditto, £80,000 5½ per cent. debentures	——	
General Mining, Limited, £219,752 fully-paid shares of £8	3¼	3¾
Low Point, Barrasois and Lingan, £509,100 fully-paid shares of £100	——	
New Vancouver Coal Mining and Land, Limited, £185,000 fully-paid shares of £1	¾	1
North-Western Coal and Navigation, Limited, £160,500 6 per cent. debenture coupons, June 30 and December 31; principal 1904	——	
Ditto, £149,500 fully-paid ordinary shares of £10	——	
Ditto, £900 fully-paid deferred shares of £100	——	
Sydney and Louisburg Coal and Railway, Limited, £50,000 cumulative 10 per cent. first preference shares of £10, £6 paid	7½	8½
Ditto, £14,560 fully-paid non-cumulative 6 per cent. second preference of £10	3	5
Ditto, £250,000 fully-paid ordinary shares of £10	¼	¾
Anglo-Canadian Asbestos, Limited, £11,500 fully-paid shares of £1	——	
Anglo-Canadian Phosphate, Limited, £46,510 fully-paid preference shares of £10	——	
Ditto, £25,000 fully-paid deferred shares of £10	——	
White's Asbestos, Limited, £20,000 fully-paid shares of £1	——	
Ditto, £15,000 shares of £1, with 15s. paid	——	
Bell's Asbestos, Limited. £140,000 fully-paid shares of £5	9½	9¾
Ditto, £68,400 debentures, 5 per cent.; interest January 1 and July 1	——	
Canadian Phosphate, Limited, £100,000 fully-paid shares of £1	¼	½
General Phosphate, Limited, 5 per cent. ordinary shares of £10, £2 paid	——	
Ditto, £5,000 fully paid founders' shares of £10	——	
Western of Canada Oil, Limited, £200,000 fully-paid shares of £100	——	
Ditto, £99,850 fully-paid shares of £50	——	
Western of Canada Oil, Limited, £199,700 12 per cent. debentures of £100	——	

Excelsior Copper.—Registered September 26, 1888. Accounts to December 31 submitted in April. No dividend yet. Liquidation and reconstruction have been decided upon.

Nicola.—Accounts to December 30 submitted in November. No dividend yet.

Shuniah Weachu.—Accounts to November 20 submitted in February. No dividend yet. Shares for £12,870 held by the Company.

Silver Wolverine.—Registered October 19, 1888. No report of meeting received yet.

Tilt Cove.—In March, 1890, the properties were leased for 99 years to the Cape Copper Company, Limited, at a rent of £4,400. The Cape Copper Company advance £15,000 at 5 per cent. interest, and when this is repaid out of profits; surplus profits are to be divided equally between the Cape Copper Company and the Tilt Cove Company. The lease may be determined by the Cape Copper Company at any time on twelve months' notice. Accounts annually to March 31 submitted in November.

General Mining.—Accounts to December 31 submitted in April, but an interim meeting is held in November. Dividend for 1884, 5 per cent.; for 1885 and 1886, 3⅛ each year; for 1887, £4 13s. 9d. per cent., and for 1888 and 1889, 3¾. Reserve fund, £29,850.

Low Point.—Accounts to December 31. For 1887, 1888, and 1889, 5 per cent was paid each year on the ordinary shares publicly held; for 1888 the ordinary shares issued to the vendors got 3½ per cent., and for 1889, 2½.

New Vancouver Coal.—Reconstructed in 1889. Accounts to June 30 and December 31 submitted in November and May. For the two half-years to June, 1889, 5 per cent. per annum was paid, and for the two half-years to June, 1890, 4. Debentures, £60,000.

North-Western Coal.—The deferred shares receive no dividend until 15 per cent. per annum (cumulative) has been paid on the ordinary. Accounts to June 30. Dividend for 1887-8 and 1888-9, 5 per cent. per annum.

Sydney and Louisburg Coal.—Accounts to December 31 submitted about May. In respect of 1889 15 per cent. was paid on the first preference, leaving arrears of 50 per cent.

Anglo-Canadian Asbestos.—Reconstructed in 1889. At general meeting held on 16th April, a dividend at the rate of 20% per annum was declared.

Anglo-Canadian Phosphate.—The preference shares rank first for 7 per cent., and after a like rate has been paid on the deferred shares, both classes rank equally. Accounts to November 30, submitted in May. No dividend yet on either class. Debit to profit and loss on November 30, 1889, £4,784. One of the mines has recently been sold and another leased.

Bell's Asbestos.—Accounts to December 31 submitted in January. Dividends for 1888 and 1889, 22½ per cent. each year. Reserve, £5,000. The debentures are redeemable by 1913, by annual drawings at 115 from a sinking fund, which the directors may increase.

Canadian Phosphate.—Accounts to November 30 submitted in February. Eleven months to November 30, 1888, resulted in a profit of £2,576. which was carried forward. A dividend of 6d. per share is to be paid November 1, 1891.

White's Asbestos.—Registered April 9, 1889. Accounts submitted on December 31. Liquidation has been decided on.

An Assay Furnace.*

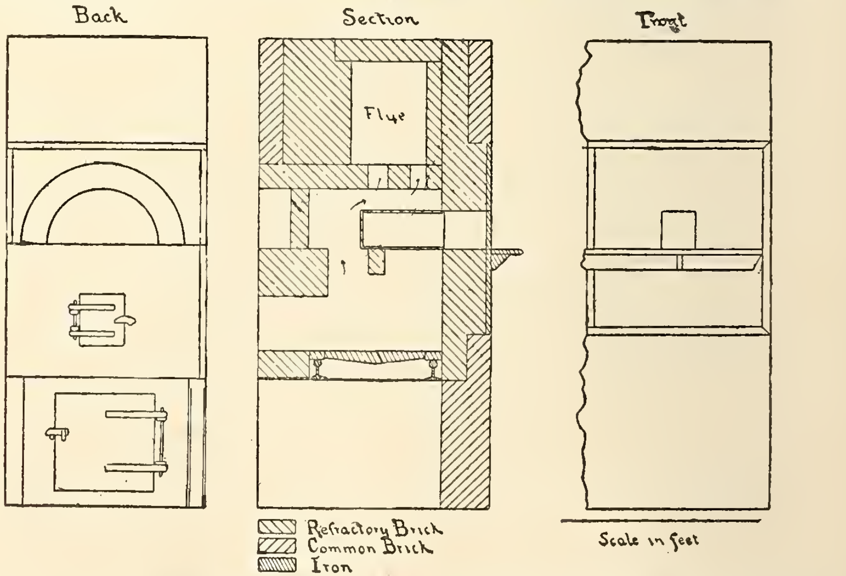
By Herbert Wood, M.A., Fellow Toronto University.

The accompanying diagram represents a muffle furnace as used in the Pueblo Smelting and Refining Company, Colorado. This furnace is one of a group of three which stand side by side, and the flue here given is the one used by the three furnaces. A flue measuring 6 inches by 8 inches is, however, quite large enough for one furnace. The approximate cost of such a furnace is about $100:

400 fire-brick	$20
400 red brick	5
200 lbs. fire-clay	8
Mason, five days, $5 per day	25
Castings	20
Extras, mortar and carpenter	10
	$88

For transportation, etc., will require about $10.

Such a furnace is hardly suitable for a mine unless it is well equipped in its various departments, and has a large amount of fire assaying to do.



The superiority of this style of furnace over every other consists in:—

Its economy of fuel (I have made cupellations on 16 lbs. of soft coal); its cleanliness, being far less filthy than the Kerl furnace, which is fed in front.

Its rapid heating and excellent draughts.

Its large muffles.

I have worked with the Kerl furnace, the double muffle and the Battersea and I consider this the best.

A furnace which is fed behind is always to be preferred to one fed in front, since the heat and dust of the latter is not recompensed by any gain in time—if indeed there be any gain in time. If the grate be properly cleaned or barred out with a long iron bar, and sufficient coal put in, the quantity being easily determined by practice, it need not be touched again during the assay. The increase of temperature required at the end of an assay for brightening a bead, removing the last traces of lead, or perfect liquidation in scorification, can be got by stirring the coal a little and closing the furnace door. The draught is excellent, and the position of the flues, as will be seen, causes the flame to circulate entirely around the muffle. There is one disadvantage, and that is the danger in feeding of breaking the cross-bar, *i.e.*, the supporting fire-brick under the muffle; this may be remedied, however, by constructing knees or projections from the wall which serve as a rest. With care a muffle in constant use should last a month, and then a new bottom may be inserted from an old muffle. When the muffle finally becomes unfit for use the bricks in the arch are carefully shoved in without damaging them, so that they may be used again, and the new muffle thrust into position. The arch is again walled up with fire-brick and fire-clay mortar. A little fire-clay mortar at the front where the muffle touches the door, is often necessary. The furnace should now be allowed to stand a short time till the mortar is nearly dry. The muffle should be placed with a slight slope from the back to the door. This admits of a free circulation of air, and enables the operator to see into his cupels.

Another slight objection which I found in working with this furnace was the distance of the muffle door from the floor. It will be seen by the diagram that it is four feet. For my own use and for others of medium height, six inches less would make it more convenient.

The size of the muffles used is:—

Small size, 9 inches by 15 inches.
Large size, 13 inches by 15 inches.

I have made thirty cupellations at once in the large size and got crystals on all. Twenty crucible assays may be made without difficulty at one time.

The most refractory ores may be made easily by crucible process. About thirty to forty minutes is required for a crucible assay in this furnace. I worked some eight months with this furnace and met with no such satisfaction in any other that I ever used.

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* School of Mines Quarterly.

MACHINERY MECHANICS & INVENTIONS

Electric Power Transmissions in Mining Operation

(Continued from page 105.)

THE ELECTRIC MAGNETIC RECIPROCATING ENGINE.

BY CHARLES J. VAN DEPOELE.

One of the recent developments in the electric line is the perfection of a new electric-magnetic reciprocating engine.

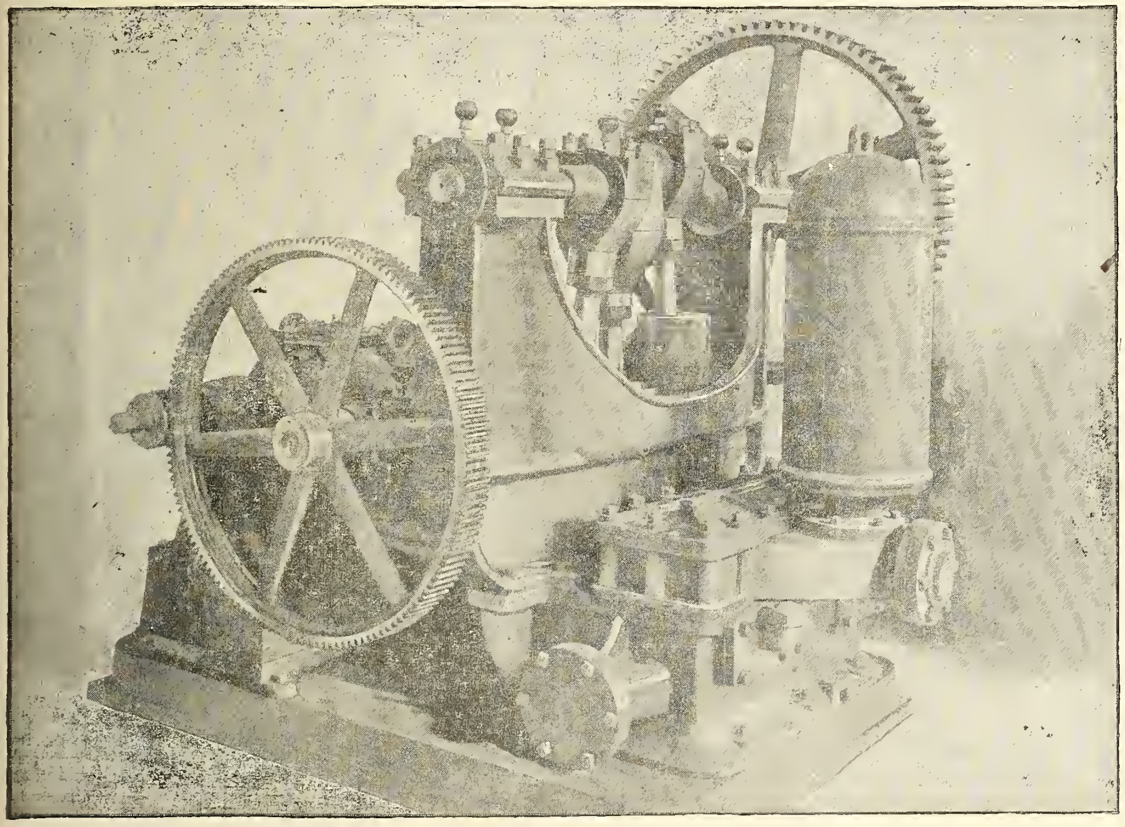


FIG. 12.—GOULD ELECTRIC PUMP.

For years past, and, indeed, ever since electricity was first used to magnetize an iron bar by means of a coil of wire, the idea of producing a reciprocating motion by the electric current has been entertained, and many unsuccessful attempts have been made to construct and operate such machines.

It is a well-known fact that when a current is made to flow through a coil of copper wire, or what may be termed a solenoid, a bar of iron placed near the ends of such a coil will be sucked into the solenoid, and the moment the current is broken the plunger or iron bar will be dropped by its own weight, or may be expelled by means of springs if the machine is in any other position than vertical. This principle, however beautiful, could never be successfully applied in the construction of heavy machinery on account of the make and break of the circuit, which has to take place in order to produce the pulsations of the current which causes the pulling and letting go of the plunger.

Not until the invention and construction by the writer of an electric generator which would give currents rising and falling at a definite speed, could the current be sent to the coils of a reciprocating engine, there alternately attracting and repelling its plunger. In this apparatus, however, as will be seen later on, the rising and falling of the current is produced in such a way that it is absolutely certain that no spark is produced either in the machine or in the generator producing the current. The current is caused to rise and fall in closed circuits, and actuates the plunger of the reciprocating-engine with a speed corresponding absolutely to the speed of the defined rise and fall of currents produced by the generator. Thus, the generator can be caused to produce, say 400 pulsations of current a minute, or it can be made to produce either a higher or lower number than this, so that the engine's speed can be regulated according to the size of its piston and the work it has to do.

The engine itself is a simple piece of machinery, consisting of two or more coils of copper wire, or solenoids, incased in an iron envelope protecting them from outside injury. Within these coils is placed a brass tube, and within this an iron plunger, capable of moving to and fro under the action of the currents in the coils. To the end of this iron plunger is attached a piston-rod, similar to that of an ordinary engine, and to this is attached the hammer, drill or whatever tool is to be operated by the engine.

A very simple means of connecting the reciprocating-engine to the current, is applied to the machine, so that it can be stopped and started instantly. The cables leading from the generating-station to where the current is to be used, are perfectly insulated in the usual manner, and switch-boxes are disposed along the main cables. From these, flexible cables are led to the reciprocating-machine, so that it can be moved, if necessary, from one place to another, without any trouble whatever. The cable is incased in a rubber tube to protect it from injury and to prevent loss of current by contact with the ground.

It will readily be seen that one of the first applications of these machines will be to rock-drills, such as are now in use in nearly all mining and rock-work, for quarrying, prospecting, etc. The simplicity of the machine lends itself most readily to this application, as it will be seen that there are no movable parts on the whole machine, except the plunger and piston-rod carrying the tool. There are no valves, as in steam-engines, no switches, no make and break of the circuit, and no exposed current-carrying parts, so that the whole can be handled with safety and without any skill above that of common laborers. By turning on the switch the machine is started; by turning off the current, it is stopped. There is absolutely nothing to be done to the machine, except occasionally to pour in a few drops of oil, to lubricate the piston and its rod.

For ordinary mining-work the drill is mounted on a tripod similar to that now in use with the steam and air-drills which are well known to-day, or it can be attached to horizontal bars or to vertical columns; in in fact, it lends itself to absolutely the same work as has been done heretofore by the air and steam drills. It will work in any position, from horizontal to vertical. The weight of these drills will be approximately the same as that of the steam or air drills of the same capacity, and everything is so arranged that the men accustomed to work the latter machines will find no difficulty in operating the new electric drills.

The apparatus for generating currents to operate these drills or electro-magnetic engines, can be placed at any distance from where the drills are at work, and any number of drills can be worked from the same source, each drill working independently of the other, and whether one or more are in operation, the generator will regulate and furnish a current exactly proportional to the demand.

Where a long distance exists between the generator and the place where the current is to be distributed, a system of conversion is used; that is, the current is changed from a high to a low potential, so that the primary current, transmitting the power from the prime motor, can be of a high tension. Since this current could be guarded against possible contact, there would be no danger in using high voltage. At the point of application, the high potential is converted to a low potential of such pressure only as may be found desirable and practicable. Where the distance is, say, only 1 or 2 miles, it will not be neces-

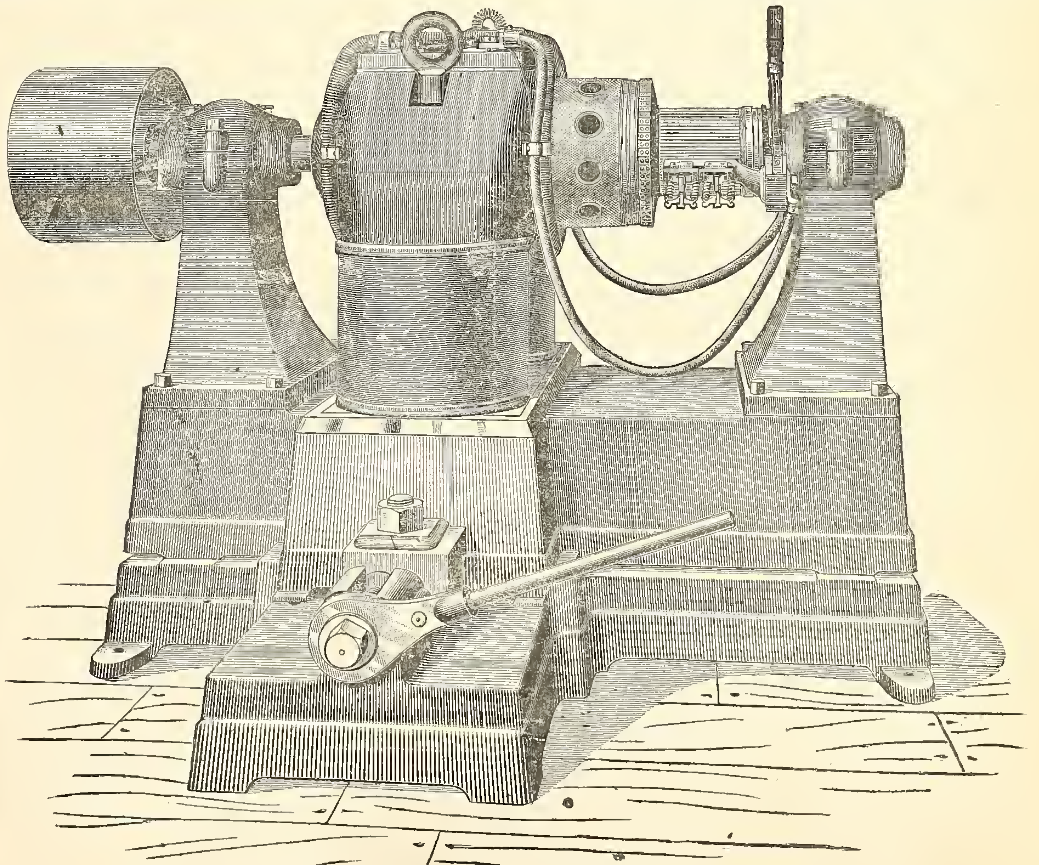


FIG. 13.—GENERATOR.

sary to use any system of conversion whatever, as a current of suitable potential can be run directly from the generator to the mines.

The main advantage, however, is the superior economy over the motors now in use where steam or air is to be conveyed to a distance of only a few hundred feet. There is an enormous loss in this transmission, and methods of steam or air-transmissions are certainly very limited in scope. There is, also, the trouble of leakage, making a system of piping much more costly in maintenance; but this is done away with when electricity is employed. All parts are so simple, that they will require little or no repair for very long terms; and such repairs as will have to be made, will always be much less expensive than in the case of steam or air-driven machines.

THE PRACTICAL APPLICATION OF ELECTRICITY TO COAL MINES.

By J. S. Doe.

It is now only about fourteen months since the Jeffrey electrical coal-mining machine made the first really practical test of electricity in the mining of coal on record in this country. This was carried out in April, 1889, in the mines of the Shawnee and Iron Point Coal and Iron Company, at Shawnee, Perry County, Ohio, in what is known as the Big Vein coal field of Hocking Valley. This company had previously been experimenting upon electrical haulage, and, to this end, had put in a power-plant consisting of a 40 horse-power generator, built by Foree Bain, of Chicago, Ill., with an exciter, both being belted direct to a Beck high-speed engine of 60 horse-power. The terminal potential of the generator is 260 volts, and that required by the mining machine motors is 220 volts; therefore, there is a loss of 40 volts in the line. In the course of the experiments at the Shawnee mines, the Jeffrey Manufacturing Company, which had been manufacturing for the past ten years a coal-mining machine run by compressed air, was called upon to assist the coal company in the installation of its plant, and, in connection with that work, made and put in for trial the first electrical mining-machine. The same machine, with only a few minor changes, has been in practical daily operation in the mines ever since; and during the same period the Jeffrey Manufacturing Company has installed or contracted for 23 electrical mining-machines, as follows:

The Thurmond Coal Company, Thurmond, W. Va., four machines, with two 80 horse-power generators, and two 85 horse-power high-speed engines.

The Sterling Mining Company, Cannelton, Pa., two machines, with one 80 horse-power generator, and one 85 horse-power engine.

The Monongah Coal and Coke Company, Camdenburg, W. Va., five machines with three generators and three engines. This company will add more machines as fast as territory is opened to permit their use.

The Consumers' Coal Mining Company, Spilman, W. Va., two machines, one 60 horse-power generator, and one engine.

The Ellsworth and Morris Coal Company, Jobs, Ohio, four machines, with two generators, and one 150 horse-power engine. This company has also given an order for another plant of four machines.

The Upson Coal Company, Shawnee, Ohio, is now putting in a plant to consist of two or more machines.

All the foregoing plants have sufficient additional power to run from one to four more machines when required. A number of other orders, calling for many machines, are under negotiation at this time, and several of the above companies have contracted for additional machines, after a practical trial of their first ones, thereby testifying to their satisfaction with the use of electricity in coal-mining. The distance from the power-house to the working places in the mines, varies in the above instances from 1,000 to upwards of 5,000 feet.

As already observed, the motors on the mining machines are wound for 220 volts, with a capacity of 15 horse power. This voltage has been found to be perfectly safe, there being no danger from any accidental contact with the wire. The amount of work done by each machine averages from 600 to 900 square feet of surface under-cut in 10 hours. It requires two men to handle the machine. The machines cut into the coal or fire-clay bottom, as may be desired, at the rate of about 1 to 1½ feet per minute; the standard machine under-cutting 5 or 6 feet deep, 39 or 42 inches wide and 4 inches high. After the cut is made, the cutter-bar is withdrawn by throwing a lever; the machine is then moved over the length of the cutter bar for another cut, and proceeds as before. Upon completion of the room, the machine is loaded upon a truck provided for the purpose, and moved into another room for more cutting; the first room being then drilled and the coal shot down for loading.

The same power, electricity, has been applied to the running of electric drills, manufactured by the Jeffrey Company. These drills penetrate the coal at the rate of two or more feet per minute. The mines are also, in some instances, lighted by incandescent electric lamps. Electricity is also applied to the running of pumps and fans in some of the above named coal mines, with perfectly satisfactory results. There can be no doubt that electricity in coal mines has become a permanent, practical success. We are, however, only in the infancy of its uses. There will be many and valuable improvements made as time progresses; but, with the light we have, it is evident that considerable advantages will accrue to those who first put in electrical coal-mining machinery.

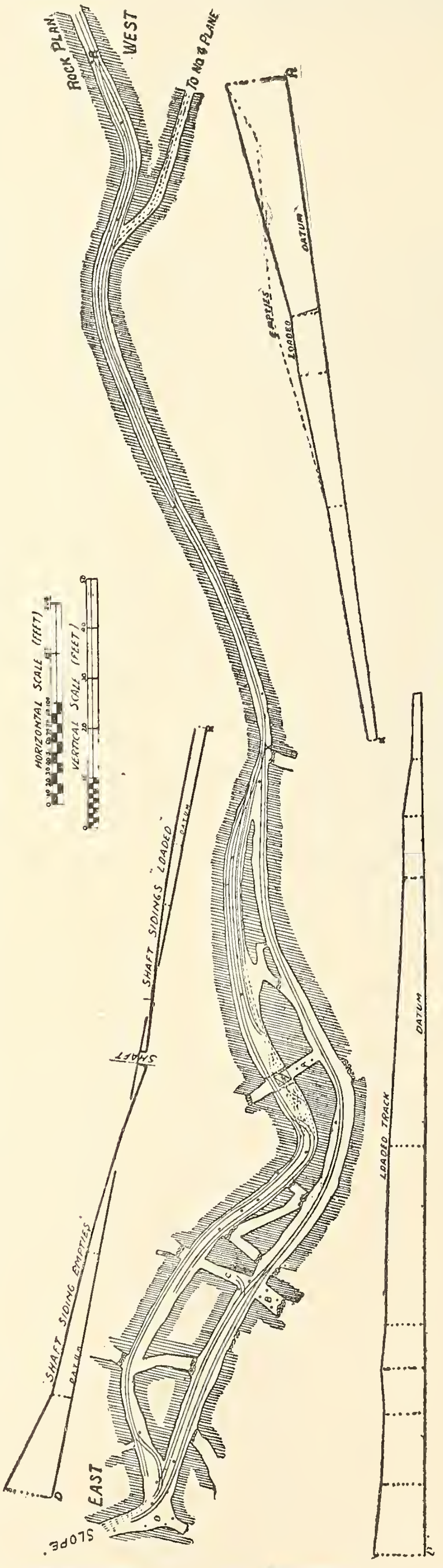


Plate 1.

Fig. 8.

Plan and Profiles of Haulage at Hillside Colliery, Pa.

The saving in the cost of mining coal by machinery, as compared with hand work, varies considerably in different localities and in different sized veins; but it may be roughly estimated to average about 20 to 25 per cent., with an additional saving of merchantable product, since machine-mined averages coarser than hand-mined coal.

A few words may be added on the use of electricity in the hauling of coal. It is unnecessary, at this late day, to call attention to electricity as a motive power in the transportation of heavy and quick-moving loads. Our many street railway lines give us daily an hourly demonstration of that. The Jeffrey Manufacturing Company is building and has in practical operation electric mine motor cars of 20 horse power capacity, each weighing 5 tons; the same type of motor, with the same voltage, being used as on the mining machines. The frame of the motor car is made of cast iron, with heavy cast iron draw bars, and pilots to clear the track of any obstruction, such as coal, etc. The wheels, 20 inches in diameter have steel tires with steel axles, power being transmitted from the motor to the axles through straight pinions and gears. The speed of the motor car is 8 miles per hour. The electrical power is transmitted to the motor by means of a 4-wheeled trolley running on a double all-metal line, placed along the side of the entry, there being no rail or ground return. Sand boxes and electric head lights are placed upon the motor. The "motorneer" sits at one end, and handles and guides his iron horse, fed from nature's storehouse, with far more comfort and ease than can be had with the stubborn mule.

The Jeffrey motor car has hardly as yet demonstrated its maximum power. We cannot say how much coal it would haul on a level. It has hauled as high as 50 tons in one train, up and over a 4½ per cent. grade. The Shawnee and Iron Point Coal and Iron Company have one of these cars, and the Thurmond Coal Company another, while the Upson Coal Company is putting in the plant for one.

ACCUMULATORS AND MINING.

By Francis A. Pocock.

At the Washington meeting in February, 1880, Mr. Pedro G. Salom read a paper on "Electrical Accumulators, or Storage Batteries."

In the following paper, it will be my object to investigate the question, as far as possible, from a purely mining point of view. That the use of accumulators in mines is not far off, is almost certain; and it will be of interest to many of the members to see how far this reservoir of power will bear filling and drawing upon at the present time, and what the relative cost of the two electrical systems may be expected to be, not so much in first outlay as in the running expenses of the plant.

The first thing to be decided is the weight of these accumulators, and the easiest way to define this, is the weight per horse power. Mr. Salom says, it takes 25 pounds of battery to give 1 horse power hour, and that to give 100 horse power hours, or 10 horse power for 10 hours, requires 5,500 pounds of battery or 220 elements; but 25 pounds is the net weight and 32 pounds the real total upon which we must base our calculations, so that we have a total of 7,040 pounds as the weight of this battery. The next question is, how much room will this take upon a mine locomotive? A mine locomotive of 10 horse power should not be more than 9 feet long, and 2 feet of this will be taken up by the bumpers, leaving 7 feet in length for the battery. Then for a 3 foot track it should not be more than 5 feet wide. Allowing 1 inch all around a cell, it will be possible to set ninety-six of these on the floor-space of the locomotive; but we must have fourteen more than this, which will make the width 68 inches. The height of this cell is 8 inches; and, allowing 2 inches space above it, and 1½ inches of plank, the top of the second tier will be 19½ inches high above the floor.

If the motor is to be placed below this floor (and there is no other place for it), then the bottom of the floor will be 2 6 inches from the track; and, allowing the floor to be 3 inches thick, to stand the weight, the top of this car will be 4 feet 4½ inches above the track. Remembering that the height of the 40 horse power motor at Lykens Valley is only 4 feet high, and the one at Erie Colliery, also 40 horse power, is 4 feet 4 inches high, and that they are both narrower and of the same length as the proposed storage motor, and of four times the power, there is certainly one point established against the present use of accumulators.

Table of Weight, etc., of Electric Mine-Locomotives.

Location.	Horse-power of Motor.	Weight of Locomotive. Pounds.	Largest Load. Tons.	Speed. Miles. Per H'r.
Zankerode . .	4.5	3000	13½	6
Paulus	5 to 6	4200		6
Lykens	40	12,000	165	6.8
"	40	12,000	150	6.8
Shawnee		4500	21	5
Buckingham.		7000	60	8
"		4000	30	8
Bear Run . . .	60	18,000	150	6
Erie	40	13,500	107	6

Returning to the subject of weight, we calculate that, to that of the accumulators, 7040 pounds, must be added that of the motor, say 1300 pounds, the wheels and axles, say 1100 pounds, and the frame of the machine, say, for strength alone, 1400 pounds, giving the total weight of motor, etc., as 10,840 pounds.

From the above, it appears that the small German motors weigh about 700 pounds per horse power, and that the large American motors only weigh 300 pounds per horse power, whereas the accumulator motor would weigh at least 1000 pounds per horse power. It is true that weight is necessary to traction, but it it also true that unnecessary weight will entail loss of power, and from the very limited information at hand it appears that 700 pounds per horse power is found to work satisfactorily with small motors, and that the weight per horse power decreases as the horse-power increases. Consequently, for a 10 horse power motor, 1000 pounds per horse power appears to be too high. There will be a waste of power in moving this weight and, if we wished to operate a 40 horse power locomotive with batteries, the number of cells would be 880, and their weight 28,160 pounds. They might be divided into two batteries and towed in a tender, but even then each would weigh 14,080 pounds and this would absorb at least 500 pounds of the total pull of the motor, when running on the level, and considerably more where grades are to be overcome.

Dr. Lewis Bell has pointed out that, whereas a good roadbed is necessary for electrical traction by overhead wire, it is even more imperatively so when storage batteries are used. We have found in practice that a 25 pound per yard steel rail is too light for a locomotive of 13,000 pounds weight to be run upon ; therefore, there is no saving to be looked for in this direction by the use of accumulators. On the contrary, when we begin to put in a roadbed heavy enough to stand the weight of a locomotive weighing, say, 23,000 pounds, there are many disadvantages that the colliery manager will be the first to see. Besides the first cost of the track, the keeping of this weight of track in good repair, in a mine where the floor is forever moving (as it is in many of our mines), would be a work of no slight expense in itself. It appears, therefore, that not much is to be expected from accumulators as a means of haulage.

However, this is one side of the question only. There is another side which should be considered, and that is the use of the accumulator motor in collecting the cars to a point where the heavy haulage motor can reach them. The prospect, as viewed from this point, is more encouraging. From what I have seen of the work, a motor of about 5 horse-power would do the work of three or four mules, and the weight would be about 5000 pounds, as follows :—

	Pounds.
Accumulators (110 cells)	3500
Motor	600
Wheels and frame	1000
Total weight	5100

This machine could be built low, so as to take up little height. It is only possible to make this form a commercial success, in my opinion, when the gangways are low and the roof would have to be cut to gain height enough for mules to work. Then, the cost of the cutting saved by the use of the motor would counterbalance the repairs on the battery and the extra care and expense in laying and keeping the track in order. The cost of the system may be estimated as follows :—Assuming the first cost of the locomotive complete to be $2300, and allowing that the mine can afford to charge these cells for $40 per horse power per year, the generator and engine being already installed and doing work during the day time, and this sum representing fuel and interest on machinery. The attendance should not be more than $300 per year, as the pump man and night engineer can do the work :—

Estimate of Expense of 5 Horse Power Accumulator Motor.

Interest at 6 per cent. on $2300	$138.00
Repairs to battery	500.00
Repairs to motor, etc	150.00
Cost of power, at $40.00 per horse power	200.00
Attendance in charging at night	300.00
Engineer, at $2.00 per day, for 260 days	520.00
	$1808.00

The cost of running three mules and drivers would be about as follows :—

Interest and depreciation (26 per cent.) on $450.00	$117.00
Feed, shoeing, harness and attention, at $0.33 per day	361.00
Three drivers, for 260 days, at $2.00 per day	1560.00
Total	$2038.00
Less	1808.00
Annual saving on 3 mules	$230.00
Or, for 4 mules : total expense	$2717.00
Less	1808.00
Annual saving on 4 mules	$909.00

Or, about 44 per cent. on the investment, under the circumstances assumed.

The rail and track being an important item in the economy of this method, I think that perhaps the cheapest, and at the same time the best method would be to use from 20- to 25-pound steel rail, and, in laying the track, to place the ties first about 3 feet apart from centre to centre, and on these, and under each rail, to place a string-piece of wood 1½ by 3 inches, nailed to the ties, and spike the rails on the top, keeping the stringer-joints and the rail-joints from coinciding. The combination makes a solid track, and a very smooth-running one, and it has the advantage of not lifting easily into very uneven points ; the ends of the rails do not jump as when only laid on the ties, and the track has not the spring to it which is so injurious.

The true place for accumulators at present is in lighting, and it looks as if they could be used to advantage in this connection. They are very heavy, it is true ; but the lighting-arrangement for eight hours' work would not be a large or very heavy affair, and could be taken to the working place on the first car, and brought out on the last, so that it would not have to be carried by hand at all. The advantage to the operator would be material, as the men can work better in good light than in poor, and the coal would come faster and cleaner from a well-lighted place. The lighting of switches, turnouts, etc., could be easily accomplished in all parts of the mine, and the jar which would be detrimental to traction would not occur in this case. The charging could be done at night, and a clear steady light delivered during the working hours.

THE USE OF ELECTRIC POWER TRANMISSION AT ASPEN, COLORADO.

By C. E. Doolittle.

At the request of Mr. Spalding, I give a brief statement in regard to the plant in use at this place by means of which water power is utilized for generating electric currents and the latter are applied to mine hoisting, etc.

This mining town had been lighted by electricity for three years, the power being obtained from several small water powers, when owing to the limited quantity of water flowing in the mountain streams of this region in winter, it became necessary either to put in a steam plant or to use water under a much greater head. It was determined to adhere to water power ; and the construction of a plant to use water under a head of 900 feet, was begun eighteen months ago.

A dam was built on Hunter Creek, about three miles from town, at a point where a dam 12 feet in height creates a reservoir covering several acres of ground. It has been necessary, during a few of the coldest winter nights, to draw upon the supply of water in this reservoir, but the reservoir always refilled itself during the following day.

From the dam the water is carried some two miles in a wooden flume, buried in the ground, to the head of the pipe-line. The pipe-line is 4500 feet long, and has a fall of 876 feet, giving a pressure of 380 pounds per square inch at the water wheels. Lapwelded pipe, 14 inches in diameter and about ¼ inch in thickness, is used.

In the power-house there are eight Pelton water-wheels. each two feet in diameter, and each capable of developing 150 horse power. The water wheels run at the rate of 1100 revolutions per minute, and each wheel is belted directly to one or more dynamos.

This power has now been in use more than a year and has proved absolutely reliable. The wheels at present furnish power to operate three arc dynamos, sixty lights each ; four incandescent dynamos, supplying 2500 incandescent lamps, and two 500 volt power dynamos, one requiring about 60 horse power, the other about 120 horse power under full load.

These power generators furnish current to electric motors used principally for hoisting in mine inclines. For this purpose, motors of the street car type are used, so that the speed is under control of the engineer. The motors are connected to ordinary mine-hoists by spur gearing and paper friction wheels. These electric hoists are all underground, at points where it would be both difficult and expensive to obtain power in any other way. The distance of the motors from the dynamos is, in most cases, about 2 miles. Some of the hoists have been running more than two years, and all have proved satisfactory and reliable. The expense for motor repairs has been very small. There are also motors in use for running blowers, rock-crushers, etc. The motors range in size from 3 to 75 horse power.

An electric tramway for mine use is now in process of construction. The locomotive for this purpose consists of a street car motor, mounted on a truck, with the armature shaft at right angles to the car axles. This arrangement involves the use of a set of bevel gears. There should be a special motor for this purpose, so designed that the locomotive will not be too broad to run on the 18 inch gauge tracks when the armature shaft is placed parallel to the axles, thus allowing spur-gearing to be used.

While the application of electric motors to hoisting has been a pronounced success, there are still two obstacles in the way of the general utilization of electricity for all mining purposes, viz., the lack of electric drills and electric pumps. As soon as an electric drill is produced that will do the work of an air drill, and an electric pump that will take the place of the present sinking pump, then the time for the general application of electricity for all mining purposes, to the exclusion of other power, will be at hand.

Mould's Hydraulic Coal-Getter.

For a considerable time past, Mr. E. Mould has been endeavouring to design a suitable mechanical contrivance that would take the place of explosives in dusty and fiery mines. He has produced screws and hydraulics of various forms, as well as a cylinder in the far end of the hole and water forced through a tube. But the bursting of the tubes was a nuisance. He then tried the cylinder outside, but this design was too heavy and cumbersome and others inefficient. However, he now claims to have designed an instrument of a little over 60 pounds in weight, to break loose almost any coal in the ordinary way of working.

This apparatus, which may be used as an ordinary hydraulic jack for any lifting purposes up to 10 tons, is thus described by the inventor :—There are (1) the head, (2) the cylinder, (3) the mandrel, (4) the piston-rod, the side pieces and the pump handle. The side pieces and the pump handle are the only loose parts.

The head contains the pump, and in part answers the purpose of a reservoir.

The cylinder is simply a round parallel barrel, screw-threaded at each end, and is so connected to the head at the top end and to the mandrel at the bottom end. This cylinder is covered by a shell cylinder, leaving a cavity between the two—the inner and outer cylinder. The inner cylinder is perforated on the side at the bottom end, to allow the water to pass from the under side of the piston while it is being forced into the cylinder on the top side of the piston by means of the pump, thus supplying the pump during the operation of breaking loose the material in which it has been placed. As already stated, the inner cylinder is screw-threaded at each end. Now, while it has been screwed together, the outer shell is drawn into faced joints, both top and bottom end, and is so made water-tight, and becomes a portion of the reservoir for water. Thus there is ample provision in the head, the cylinder, and the cavity. This is to avoid the necessity of constantly refilling with water, which may be more or less unclean.

The mandrel is screwed into the bottom end of the cylinder, and so becomes a permanent joint. The mandrel is also provided with recesses, constituting inclined planes. In these inclined planes are placed side pieces or wedges, thus making the mandrel cylindrical in form, and is so placed in the hole prepared for it.

In addition to the cylinder and a piston, there is a piston-rod. The rod passes from the piston in the cylinder through the mandrel, and on the bottom end there is placed a collaring, so as to enlarge the bearing, because this becomes the basis of pressure. It is very important that the machine should go to the far end of the hole, and to ensure this the drill should always be ⅛ in. larger in diameter than the machine.

Now, supposing the machine is in the hole, quite at the far end, the moment pumping is commenced, the piston-rod being against the far end of the hole cannot go forward, therefore the machine moves outward, and the frictions on the sides of the hole being greater than that of the incline planes, the said pieces become fixed, and the machine moving outward, produces lateral pressure by means of the incline planes, thus forcing asunder the material in much larger blocks than when exposed to the shattering influence of an explosive ; securing better results, and at the same time avoiding all the evils contingent on the use of explosives.

The merits claimed for this machine are :—(1). Efficiency. (2). Portability, being a little over 60 lb. when charged with water ; the same is used over and over again, it may be for months, so that you see the pump is intact ; and this is accomplished by the simple means of a thumbscrew. When the operation is completed, by turning a thumbscrew, the water returns to the underside of the piston. (3). Economy, being less in first cost, and less liable to get out of repair, its loose parts being so few in number—viz.: side pieces and pump handle. (4). Simplicity—place the side pieces in the recesses of the mandrel, force it to the far end of the hole ; if the coals are to be lifted up or forced down the side pieces must be top and bottom. But if the coal is to be forced sideways the side pieces must be right and left. Then commence pumping, and in about five minutes the coals will be down or on the sprags ready for dropping as required.—*Colliery Guardian.*

Electrical Transmission of Power for Mining Work.—An electric plant is now being installed at the Loganlea collieries, near West Calder, Scotland. A new engine house has been erected with an engine of nearly 100 h.p. The dynamo used will develop 60 h.p. at a pressure of 200 volts. At the bottom of the mine a large road—to be used in working the main seams—is being driven through the solid stone. A motor of 30 horse power will do the bulk of the hauling here. The water met with in the construction of the road will be pumped to the surface by means of another motor of 15 horse power. When the installation is complete it is estimated that it will develop about 150 horse-power, capable of being applied not only to the purposes mentioned, but to rock drilling, coal drilling and coal cutting. It will also serve to light up the whole of the extensive works. The installation at Loganlea, it is believed is the first of its kind in Scotland.

A New Granulating Mill.—The American Ore Machinery Company have just completed a new mill for producing a granulated product, from the size of a wheat-berry down to a twenty-mesh screen. This mill is called the Narod Granulator. It is of the same size and type, and about the same weight as the Narod pulverizer, and requires the same horse power, namely, 15 to 20. It differs only from the Narod pulverizer in having a screen in the base instead of around the mill, and in the absence of the six spiral fans by means of which attrition is engendered on the pulverizer. The demand for the granulator promises to exceed that of the pulverizer, hence there will be a very wide and profitable field for this new mill.

Coal Cutting By Machinery.

The principal inducement to operators to use coal cutting machinery in preference to mining by hand labor is naturally due to a reduction in the cost of getting out the coal to be gained by the former method. With it it is possible to effect a larger saving of coal than is possible by hand labor, due to the small height of the undercut; also the number of men which have to be employed can be materially reduced. To get out the same amount of coal it is not necessary to keep as many working places open, in mines using machinery, as it would be when employing hand labor, thus making it possible to have the working places more concentrated, and thereby to save a large amount of expense in the form of dead work, such as keeping open gangways. To give an approximate idea of the cost of mining with machinery, as compared with hand labor, it can be stated that a coal cutter in the Hocking Valley is capable of giving an output of eighty to eighty-five tons a day. The price paid for cutting coal by machines in rooms is 8 cents per ton; the price paid for loading coal after the cutting is 35 cents per ton. A miner can mine and load on a average 3 tons per day, being paid 70 cents per ton. This shows a cost of 43 cents per ton of coal mined by machines against 70 cents mined by hand. To the former will have to be added wages for one engineer, fuel, interest and depreciation, and wear and tear of the plant. By working the machines day and night, however, these last items can be reduced to a minimum. This policy is being followed in most mines using machinery, as it enables a comparatively small machine plant to give a large daily output. For example, should an output of eight hundred tons per day be required, and the machines be worked during the day only, ten coal cutters (with the necessary engines), etc., would be required. By working day and night five coal cutters would be sufficient, as well as engines, generators or compressors, and ducts of half the size. The work of loading and hauling would be done during the day only.

There are at present two general styles of coal cutters in use; those using rotary cutters and those using reciprocating cutters, both of which have special features, which make it advisable to use one or the other, according to the nature of the coal. It has even been found good policy in some mines to use both styles of coal cutters, preference being generally given to the rotary, using the reciprocating machine wherever the former cannot be used, or where, as in driving gangways, it is advisable to shear the coal (loosen it at the sides), in addition to undercutting.

ROTARY COAL CUTTERS.

Of the two styles, the rotary is the more rapid machine, and is used wherever possible on that account. The general features of this machine are as follows: the undercut is made by means of revolving tools, the axis around which they revolve being either a horizontal line parallel with the coal (cutter bar), a horizontal line at right angles with the coal (augers), or a vertical line (chain-machine). The machines in general consist of a stationery bed upon which slides a movable frame bearing the cutting devices. The latter is gradually fed into the coal as the knives or tools cut the coal away in front of it. The motor (either compressed air or electricity) is attached to the movable frame or to the stationery bed, suitable gearing transmitting the power to the cutting devices. The feed is automatic, and consists either of a screw and nut, or rack and pinion. The best speed for feeding seems to be from one-ninth to one-tenth of an inch per revolution of the cutting devices; although for some coal this speed might be increased with advantage. An important feature of this style of coal cutters is a proper device for withdrawing the coal dirt or slack from the cut to prevent the knives from becoming clogged.

In the Room and Pillar Work in use in America, the coal is generally undercut the entire width of the room to a depth equal to the height of the vein. It takes about nine or ten cuts to accomplish this in a room 30 feet wide. After the undercut is made from three to four holes are drilled in the coal, about two-thirds of the height from the floor, but varying with the condition of the vein. These holes are filled with powder, and the coal shot down. After having been blasted down, the coal is loaded into the mine cars by a set of miners, and the room is cleaned up for another set of cuts. While the process of drilling, blasting and loading is going on, the coal cutter is taken into another room prepared for it, and there again undercuts the coal the entire length of the room.

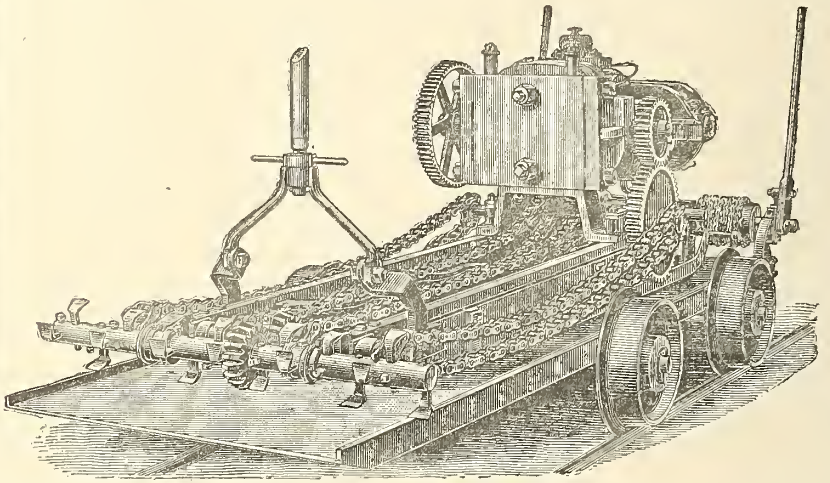
The best part of the coal is generally at the bottom of the vein, and it is therefore desirable to save as much as possible. For this reason the "bearing in," or cut, is often made in the fireclay underlying the coal, if this is not too gritty, or in a slate parting in the coal. If the latter is high up in the vein, the machines can be worked from the bench. In other words if the coal underlying the parting is allowed to remain down for a sufficient distance from the face of the room to allow the machines to rest on it while making the new cut. When undercutting in fireclay, care is generally taken to cut partially in the coal, as the white clay adhering to the latter would decrease its value in the market. Wherever neither a suitable parting in the coal nor a fireclay bottom exists, and it is desirable to get out the largest amount of lump coal possible (especially in some of the small veins), the height of the cut has to be made as small as possible; it is, however, not advisable to reduce it below three inches and a half, as otherwise it may not allow the coal to tumble over properly when shot down.

CAPACITY.

The amount of work a machine is capable of performing in a given time can be expressed in tons only when the thickness of the vein and the amount of impurities in the shape of partings, bony coal or slate, etc., are known. A better method of designating the amount of work the coal cutter is capable of performing in one day is by giving the number of cuts it can make, or the number of square feet it can undercut. This daily work, of course, varies somewhat with the nature of the coal, whether the latter is hard or soft, or contains sulphur or bastard, the width of the workings, and the territory to be covered by one machine. The largest record so far made with rotary coal cutters is said to have been 52 cuts in 10 hours, or 950 square feet undercut. The average work in the same mine in wide workings is 35 cuts, or 645 square feet, for narrow and wide workings 30 cuts, or 555 square feet.

When handled by expert men and with not too hard coal, machines can make about thirty to thirty-five cuts a day in from nine to ten hours, making it necessary to prepare at least four rooms for each to work in.

With the exception of one type, all the rotary coal cutters used in America are fastened down in proper position at the face of the coal to be undercut. They then make a cut in the coal to a certain depth and of a width depending on that of the cutting device. The latter is then withdrawn, and the whole machine moved sideways and placed in position to make another cut adjoining the former. The time consumed in shifting the machines averages about 1½ minutes. To reduce this lost time as much as possible, it is advisable to undercut as many square feet as possible with one setting of the machine. There is, however, no advantage in making the cut deeper than the vein is high, that is, in a 5-foot vein, the cut would be 5 feet deep, as otherwise the coal would not "shoot" down properly and tumble over. If the coal simply settles down in its former place, it is in a worse condition for mining than if it had not been undercut. Neither is it advisable to make the machines longer than required for the six foot cut, as they would become too unwieldy. It is necessary to make the cut as wide as possible, so as to reduce the number of times the machine has to be shifted to cut the coal in a room of a certain width. The machines used by the Edison General Electric Company are capable of making a cut 3 feet 6 inches wide; machines manufactured by other companies make cuts varying in width from 3 feet to 3 feet 3 inches.



HANDLING MACHINES.

These coal cutters are generally handled by two men only, and for this reason it is necessary to reduce the weight of the machines as much as possible. It must also be borne in mind that they are not only handled very roughly, but have to do very hard work, being at times forced through coal containing small streaks of sulphur, or other impurities, harder by far than the coal itself. Should these foreign substances occur very frequently in the "bearing in seam," that is, in that part of the coal in which the undercut is to be made, the reciprocating coal cutters, of course, would be the proper machines to use. If, however, only small streaks of sulphur occur, the rotary coal cutters are generally forced through them.

The main feature of a successful coal cutter is great strength. To show that this is of far greater importance than lightness, the record is given of the time required to shift a three thousand pound machine, 36 seconds being the average time in six tests to shift the machine from one position to another. This, of course, is exceptionally quick, and it is not to be expected that men would be able to keep it up all day. This machine is probably the heaviest on the market, the motor alone on it weighing about 1,700 pounds. It is hardly reasonable to expect that the machine can be shifted in less than one minute and a half as average for a day, no matter how light it is made, and this is being easily accomplished by expert men with machines having the abnormal weights given above.

To convey the machines from room to room they are mounted on small trucks and hauled by mules or horses from one place to the other. These trucks are generally provided with a suitable winch and chain, by means of which the machines can be readily loaded. The average time to this is about 2 minutes 45 seconds; the average time to unload the coal cutter is 2 minutes 35 seconds, and to get the machine ready for the cut will take 3 minutes. A quick record for this work is one minute 45 seconds to load, 1 minute 30 seconds to unload, 1 minute 26 seconds to set and get ready for the cut. The time required to move the machine may be estimated as from 40 to 50 seconds for each room between the one cut and the one to be cut, although it may take all the way from 10 minutes to an hour before a mule can be secured for this work. A truck so constructed that it can be operated by electricity in mines using the latter for power purposes is therefore very desirable.

RECIPROCATING COAL CUTTERS.

The second style of machine used in America is the reciprocating coal cutter. As before stated, this machine is not capable of quite as rapid work as the rotary cutter. It has, however, some features which make it well adapted to certain kinds of coal and certain conditions. It has already been said that when the quantity of sulphur or similar substances is not too great in the bearing in seam of the coal, the rotary cutter can be used.

Should sulphur occur in large quantities and in the shape of what is called "sulphur balls," or "nigger heads," it will be necessary to use reciprocating cutters. Another reason for using the latter machine in preference to the former in small veins can be found in the following: In certain districts, the miners are paid for the amount of lump coal mined. The small sizes of coal which pass through the screens, having bars from one and one-eighth to one and one-quarter inches apart, namely, nut, pea coal and slack, are clear profit to the operator. In these districts the royalties on the coal are also paid by the amount of lump coal mined. Whenever the small grades of coal, therefore, have a good market, it may be to the advantage of the operator to get out as much of these sizes as possible; and this can be done by means of the punching or reciprocating cutter. All the coal coming out of the cut made by the rotary machine is in the form of fine slack, and is not marketable; that coming out of the cut made by the punching machine is generally in the shape of nut or pea coal. It is also necessary to make the height of the cut with the latter machines higher than that made by the rotary machine to enable the tool to enter it and to undercut the coal to the proper depth.

TRANSMITTING POWER.

As the work in the mine progresses, the distances at which the coal cutters have to work from the power station will increase, and therefore, quite an extensive part of the mine has to be equipped to allow coal cutters to be kept at work continuously, making it very important that the devices used for transmitting power to the machines should be small, flexible and efficient. A general comparison between the agents adapted to this purpose—electricity and compressed air—need hardly be given at this day, as the advantages of electricity for power purposes over compressed air and other agents are now too well known. Nearly all mine owners who have heretofore used compressed air plants are seriously contemplating the advisability of changing their system, having reached the limit to which their compressed air plant can be used, and recognizing the fact that the amount of pipe already laid in the mine represents a cost nearly sufficient to cover the cost of an entire electric plant, not including the steam engine and boilers.

SUPERIORITY OF ELECTRICITY.

Outside of its well-known advantages for ordinary power transmission, the electric system offers some special features that make it well adapted for use for coal cutting. It has already been remarked that to avoid letting the machines stand idle a large territory in the mine has to be equipped for them, and this necessitates a number of bends and branches in the ducts, which with a compressed air plant, results in loss of efficiency. This has no effect on an electric system. It is also a very easy matter to lay the wires for the latter in such a manner that they are at all times easy to inspect and repair if interferred with accidentally.

But the main advantages are to be found in the machines themselves. The electric motor naturally has a rotary motion, and this removes from the machine, as experience has proven, the violent vibration met with in the use of the necessarily high speed reciprocating air engines. The life of the coal cutter is, therefore, considerably increased, and annoying delays caused by breakdowns, and the frequently necessity of giving the machine a thorough repair are reduced to a minimum. The work of the machine men is also greatly reduced, as it is evident that with a machine subject to violent vibrations it is difficult to keep firm the braces which hold the machine in place. The shunt wound electric motor retains a speed practically constant under the greatest variations in the load, and more especially has not the tendency to race which an air engine has when its load is suddenly removed.

In the case of the electric motor, it is very much easier to reverse the coal cutter without stopping the motor in order to withdraw the cutting device after the cut is made, and also to save the machine or bits from breaking if they suddenly encounter a substance too hard for them to penetrate.

THE EDISON GENERAL ELECTRIC CO.'S COAL CUTTER.

Of the many different coal cutters in use at present, those that have so far met with best success are undoubtedly those using the cutter bar, that is a shaft revolving parallel with the coal in a horizontal plane, and having knives distributed all around the surface, so as to cut a groove in the coal the entire length of the bar. The type of coal cutter adopted by the Edison General Elecric Company has been in use for years, and has been thoroughly tested. This machine has the advantage of great strength, and excels other machines of the same class as regards the design and the distribution of the material to give the necessary strength and rigidity. A special feature of this machine is that the cutter bar revolves in such a direction that the coal is cut in an upward direction. This method greatly assists the weight of the machine in holding it down to the ground, and to a great extent avoids the necessity of carefully fastening it by means of braces or jacks. It is evident that if these have to be applied tightly, the machine is in great danger of being warped out of shape, unless the floor upon which it rests is very even. This trouble is often encountered with other machines, and consequently it has become customary in using them to level the coal cutter carefully by means of wedges, before applying the jacks. Such wedges are not required for the machine used by the Edison Company.

With machines using the cutter bar, the bearings holding this bar have necessarily to be very short, for otherwise the ridge of coal left standing in front of them, which cannot be reached by the cutters, would be too wide and strong to be readily broken away by the wedge-shaped front of the bearing.

It has been customary to make these bearings 1¼ inches wide, and to transmit the power to the cutter bar direct by means of a chain. In this manner the cutter har has not only to withstand the strain due to the resistance of the coal being cut, but also that of the chain itself, which, when 15 horse-power are transmitted to the cutter bar, amounts to 3,600 pounds.

The Edison Company has adopted a countershaft behind the cutter bar, to which the power is transmitted direct from the motor by means of four chains. This countershaft has bearings 6 inches long, and strong enough to withstand any strain the chains may exert on them. To transmit the power from the countershaft to the cutter bar, gears are used with peculiarly shaped teeth, which prevent the coal dust from settling between them. The only strain on the cutter bar of the Edison Company's machine is due to the resistance of the coal. The superiority of this construction to that used by the other machines is evident, when it is considered that the bar is very much weakened by the number of holes drilled into it to receive the cutting tools and the set screws required to hold them. The cutter bar is already about as strong as it can well be made. Any increase in diameter would also increase the height of the cut, which already is 4½ to 5 inches high.

There are other advantages in the design of the machine used by the Edison Company which make it adapted to withstand the rough usage to which it is subjected in mines, better than any other machine using a cutter bar. Among them can be named, simplicity in design of the feeding devices, and the use of rollers for the sliding frame, which reduce to a minimum the friction between it and the stationary bed, and decreases the danger of binding between the two.

POWER REQUIRED.

To determine the amount of power required for coal cutters, a number of tests were recently made with machines at work in coal of varying degrees of hardness. These tests have shown that a 15 horse power motor is sufficient for the purpose. In some places the power required exceeded this amount, but as the machines only ran off and on, having their full head on for about four minutes at a time, a motor having the above-named capacity was found to be sufficient; and a careful examination of the condition of the armature and magnet of the machine showed them to be perfectly cool.

The motor used for the Edison General Electric Co.'s coal cutter is capable of giving 15 horse-power when doing steady work. When running off and on only, as would be the case when used with coal cutters, it is capable of giving by far larger power. This motor is especially well adapted to the work it has performed; it runs entirely without sparking and has all its vital parts well protected. The insulation of the machine has been given especial attention, and in this respect the Edison Company has been greatly aided by its experience with the large number of its motors now running in mines and upon street cars.

The Edison Company builds coal cutters capable of making a cut 4 feet, 5 feet and 6 feet deep, by 3½ feet wide.

All coal cutters are provided with a suitable truck, by means of which they can readily be moved from place to place. The devices on the truck to load and unload the machines are very simple and efficient, and each machine is supplied with a cable 150 feet in length, and provided with suitable devices to enable it to be readily attached to the main wires and detached from them.

COST OF EQUIPMENT.

The average cost of equipping a mine with the electric plant necessary for mining 400 tons per day in a 5-foot vein of bit coal (the plant being operated 20 hours per day) would be about $9,500. This does not include steam engine, boilers and building.

Modern Explosives: Their Inflammation and Comparative Power.

Lieutenant Willoughby Walke has communicated to the *Journal of the American Chemical Society* an important paper on the comparative power of the modern explosives most generally in use. The points of inflammation of these had already been determined by the experiments of Mr. C. E. Munroe, who for that purpose had used a thin copper cartridge placed in a thin bath or paraffin infusion. The initial temperature was taken, the bath was afterwards rapidly heated till the explosive caught fire, and then the temperature was noted again by a thermometer. These figures were as follows:—

Nature of explosives.	Points of inflammation. Degrees.
Compressed guncotton	186—201
Guncotton dried in the air (results of several trials)	137—189
Pyroxyle dried in the air (results of several trials)	186—199
Hydro-nitro-cellulose	201—213
Nitro-glycerine	203—205
Kieselguhr dynamite, No. 1	197—200
Explosive gelatine	203—209
Camphorated explosive gelatine	174—182
Fulminate of mercury	175—181
Gunpowder	278—287
Hill picrate powder	273—290
Forcite, No. 1	184—200
Emmensite, No. 1	167—184
“ No. 2	165—177
“ No. 3	205—217

In order to determine the comparative power of these explosives, Lieutenant Walke used a Quinan apparatus which is on the principle of compression of small leaden cylinders subjected to the direct action of the explosive. The results obtained permit of the various explosives being classified in the following order, in representing by 100 the power of nitro-glycerine:—

Nature of explosive.	Compression of cylinder in inches.	Relative power.
Explosive gelatine (Vouge process)	0·585	106·17
Hellhoffite	0·585	106·17
Nitro-glycerine (old)	0·551	100·00
Smokeless powder (Nobel)	0·509	92·38
Nitro-glycerine (fresh)	0·509	92·38
Explosive glycerine	0·490	86·93
Guncotton, 1889	0·458	83·12
Guncotton, 1885	0·458	83·12
French nitro-glycerine	0·451	81·85
Laboratory guncotton	0·448	81·31
No. 1 dynamite	0·448	81·31
Trauzl dynamite	0·437	79·31
Emmensite	0·429	77·86
Oxonite	0·383	69·51
Tonite	0·376	68·24
Bellite	0·362	65·70
Atlas powder	0·333	60·43
Ammoniac dynamite	0·332	60·25
Volney powder, No. 1	0·332	60·25
“ “ No. 2	0·294	53·18
Melinite	0·280	50·82
Fulminate of silver	0·277	50·27
“ mercury	0·275	49·41

From this table it will be seen that nitro-glycerine explosives are the most powerful yet manufactured. What is rather astonishing is the low position of melinite, which was long regarded as one of the most powerful explosives, possessing nearly the qualities of nitro-glycerine without its inconveniences.

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The Establishment of the Manufacture of Iron and Steel in Australia.—For some time past attention has been directed towards the establishment of the manufacture of iron and steel in Australia. This has been specially noticeable in New South Wales, which is the only Australian colony that contains, so far as is at present known, materials in workable quantities for iron and steel working, and there they are undeveloped. We learn that a syndicate is now being privately formed in England with a view of thoroughly investigating and proving the deposits of minerals in New South Wales, which have already to some extent been examined and very favorably reported upon, and if it is found that the quantity and quality are satisfactory then a definite company, with limited liability, will be formed for the purpose of opening out the mines and erecting furnaces and mills on the most modern and improved type for the manufacture of steel and iron for the supply of the colonies of Australasia and other available markets, including China, Japan, Straits Settlements, &c. From what is already known as to the extent and quality of the deposits of iron ore, coal, &c., it is calculated that hematite pig iron, suitable for conversion into steel, can be made at 40s. per ton, and the cost of making steel rails is estimated at 90s. per ton, whereas the average cost of imported steel rails delivered at Sydney over the past twelve years has been £6 9s. 4d. per ton, or nearly £2 per ton more. If iron and steel works are established in New South Wales the railway commissioners have agreed to charge special terms for the carriage of raw materials to, and manufactured goods from, the works, very considerably under those now paid by the public, and the authorities are promising every facility for the establishment of works in the colony.

Patent Magnetic Separator.—Christy and Carter's Magnetic Separator is a useful machine designed for the separation of pieces of iron, such as nuts, bolts, horse shoes, &c., from bones or other non-magnetic substances which have to be ground. It is well known that iron, if allowed to pass through the disintegrator or other grinding machine, is very destructive to the machine and detrimental to some materials ground. The magnetic method employed for separating the iron from the substance for grinding is as follows:—The substance is, by means of a shaking hopper, made to pass in a continuous stream over a cylindrical barrel studded with a number of powerful electro-magnets set radially on a central core or yoke of cast iron, the outer ends being alternately north and south poles. The magnets are wound with insulated copper wires, through which the electric current passes—this current being controlled by means of the commutator at the end of the barrel in such a manner that all magnets on the descending half are active, while the ascending ones are passive. As the material is shaken down the inclined hopper, the iron, being heavier, gravitates to the under side of the bones, and, therefore, falls directly on to the magnets and clings to them, the bones or other material falling off at the side, while the iron is carried round and deposited in a receptacle underneath the machine. Several modified designs are made to suit various purposes. The small amount of current required can be produced either by a small dynamo, or, if the factory is electrically lighted, the lighting current can be used.

New Engine Governor.—A new type of engine governor, the construction of which presents some features of interest, is being introduced by Messrs. Schaffer and Budenburg, of Manchester. This appliance takes the form of an automatic expansion regulator, and is of the nature of an inertia governor, being actuated from the slide valve spindle, and the driving strap being thus dispensed with. The governor valve spindle carries a rotary balance wheel or pendulum, which is connected by means of a spring with the slide valve rod. Owing to the action of the inertia of the balance wheel upon the spring, the movement of the governor equilibrium valve is increased or reduced as the speed of the engine is increased or decreased, and in consequence an earlier or a later cut-off is effected and the speed of the engine regulated. So long as the speed of the engine is sufficiently slow to enable the spring to overcome the inertia of the weight, the valve is fully opened. If the speed is very great, the balance wheel would be practically stationery, and the valve would remain closed, the spring alone being actuated by the eccentric rod. Between these extreme limits, there is a certain speed at which the valve would open to the normal extent, and this speed would depend upon the weight of the balance wheel and the strength of the spring, the governor regulating the engine to this particular speed.

An Electrical Safety Apparatus for Cages.—In a paper read before the Federated Institute of Mining Engineers, Mr. Yates said that although great advances had been made in recent years in nearly every branch of mine engineering, we were no better off to-day for a reliable safety cage than we were 20 years ago. Engineers had either been unable to devise a good safety apparatus, or they had not given that attention to the matter which it deserved. The numerous accidents which have taken place in recent years must convince the most sceptical as to the desirability of safety cages. All were well aware that many of these so-called safety cages had been brought forward from time to time, but had not found much favour in this country, although on the continent they were very generally applied. That the safety cages which have so far been put before the public have not been an unqualified success is due to the fact that they rely upon springs to set the apparatus in action, and that something more than the mere breaking of the rope is requisite to let these springs act. The fracture of the rope is not in itself sufficient to actuate the apparatus—many of them require a release of tension or compression, whilst others depend upon the cage attaining a certain velocity. Experience has shown that an apparatus which acts indirectly, through the medium of a spring or otherwise, is not to be relied upon. What is wanted is an apparatus which will require nothing more to bring it into action than the breaking of the rope, and which will be entirely independent of everything but this. For some time past he had been at work on this matter, and the result of his labour has been the invention of an apparatus which appears to promise perfect safety in case of breakage of rope. The rope was. to all intents and purposes, the ordinary hauling rope, except that it had two insulated copper wires in the hemp core. It differed from the ordinary winding rope in no other respect, and thus so far as winding was concerned, it was practically the ordinary rope. That such a rope could be made, and would transmit a current of electricity in a satisfactory manner, was beyond doubt, for a similar rope was now in use with Armstrong's Electrical Signalling Apparatus—an apparatus for signalling between the engine house and the cage whilst in motion. The cost of applying and maintaining such an apparatus would be trifling, and he must call their attention to the fact that the apparatus combines in itself all the qualities that a safety cage should possess, and it would therefore appear that the miners had at last within their reach a perfectly reliable safety apparatus, which would make those terrible accidents caused by the breakage of ropes a thing of the past.

The Chairman said as this was the first time this apparatus had been brought before the public they were not in a position to judge of its merits until an active trial had taken place.

IRON STEEL AND HEAVY METALS

Iron and Steel.

Montreal, June 24th, 1891.—The speculation which disturbed the course of the British iron market during the month of May has now subsided, and prices have reached a more normal point. The last quotation from Glasgow for Scotch Warrants was 47/8, but this is still an extremely high figure in view of the present condition of the market. Private advices from Glasgow state that the London syndicate have still the bulk of Scotch Warrants under their control, and little or nothing is being done by outsiders in point of speculation. Sooner or later this syndicate will have to unload on the market and unless something happens in the meantime, it is expected that lower figures will prevail. Makers' prices for shipping brands are almost identical with those current a year ago, but they are still too high to compete successfully with American iron in Western Canadian markets. The reason of the present high prices is to be found in the price of fuel which in Scotland is altogether too high. It is doubtful whether those iron masters who are also coal masters and own the collieries which supply their furnaces, would not be better off if they were to close down their furnaces and sell the coal alone. This would certainly be a short-sighted policy, but it would be more profitable for them in the meantime. If the Scotch makers wish to retain their hold on the Canadian market it must be at prices from 8/- to 10/- lower than they are at present, and it is to be hoped that they will see it to their interest to to meet American competition.

A considerable quantity, however, of Scotch iron, especially of the lower grades, has been placed for summer delivery at prices ranging from $21 to $22 for No. 1 irons down to $19 or $20 for the lower grades. The quantity arriving is not very large, as business this season is much smaller than during the past two or three years.

On the American side we learn that business is very good, but prices are extremely closely cut, and many of the large furnaces have enormous stocks on hand. It is doubtful if pig iron was ever made at lower prices than it now costs to make it in the United States. It is even lower than the Scotch iron can be produced at, and it is a question whether this wonderful development of the iron trade in the United States could ever have been brought about had it not been fostered for many years by a protective policy, until it was in a position to hold its own against outside competition as it is at present. The same argument must certainly apply to Canada, especially to that branch of it concerned with manufacture of charcoal pig iron. This is a business peculiarly Canadian, owing to the plentiful supply of fuel in close proximity to the iron deposits, and both at a very short distance from the chief centres of consumption. The present ventures in the direction of the manufacture of charcoal iron are being carefully watched, and we do not doubt that before very long they will be able to hold their own against American brands. A little time, however, must be allowed for the growth of this industry, and in the meantime it is due to those who have ventured their capital that the present protective policy should be sustained for some time to come.

Very little new can be said in reference to the finished iron trade. Bars, sheets, hoops and other classes of manufactured iron continue unchanged and business is fairly good.

Ingot copper is now much firmer than it has been for a little time past, and the lowest figure of to-day is 14 cents against 13½ cts. a few weeks ago.

Tin plates continue fairly firm in view of the shutting down of so many of the works in South Wales. The attempt to force the manufacturers to keep these works going is not likely to be successful, especially as present prices cannot be very remunerative.

London, June 16, 1891.—The general position of the market is decidedly uncertain though no material change has occurred. The "squeeze" in warrants seems about over, and values will, it is supposed, before long drop to their proper level. At present they are very irregular, and their exact position is hard to define. Very little has been done in warrants, the "bear" account having been reduced to small dimensions. There is some curiosity to observe how the "bulls" will "get out" of their warrants, and also as to whether the ascendancy of Glasgow has been really broken by late occurrences. Connal's stocks at Glasgow are increasing slowly, while shipments are small, and the importations of Cleveland pig iron into Scotland on a large scale. In some of the finished iron departments there is rather more work in hand, and the engineers are pretty well engaged, but, as a whole, the outlook is not very brilliant.

Scotch Pig Iron Warrant Market.—Following is our usual table of statistics:—

	1891.	1890.	1889.	1888.	1887.
Scotland.					
Price of Scotch warrants, June 9..................	48/6	44/7	42/7	38/1	42/-
Furnaces in blast in Scotland, June 9.....	66	84	82	87	78
Quantity of iron in public stores..................	515554	733877	1027353	991676	883055
Shipments of Scotch pig iron for week ending June 6.	5295	9466	6237	10738	6531
Do. since beginning of year..	104523	202131	182640	174318	172407
Middlesbro' iron imported at Grangemouth, week ending June 6.............	7461	2190	3680	4026	7195
Do. since beginning of year..	160165	57304	154503	153954	158967
Cleveland.					
Price of Middlesbro' No. 3 warrants on June 9......	39/9	41/2	37/7	31/7	34/10
Furnaces in blast in Middlesbro' district..	89	103	104	94	94
Quantity of iron in public stores*.................	129586	100524	223282	291742	336804
Shipments of pig iron from Middlesbro' for week ending June 6.............	20775	20058	18254	22460	18884
Do. since beginning of year..	368260	353897	435703	431711	350484
West Cumberland and North Lancashire.					
Price of hematite M/Nos. warrants..	49/9	50/7½	48/5	42/1	43/9
Furnaces in blast in W. Cumberland and N. Lancashire..	41	45	56	49	54
Quantity of iron in public stores†.................	139718	302155	41573	427422	323741
Shipment of hematite iron for week ending June 6.....	8440	9025	5828	12327	12691
Do. since beginning of year..	220240	242830	235960	203478	254816

* Connal's & N. E. Rly. Co's.

† Workington, Maryport, and Barrow.

New York, June 26th, 1891.—The number of furnaces in blast on June 1st was 258, with a weekly capacity of 146,782 tons, as compared with 227 with a capacity of 115,590 tons on May 1st. The increase is due to the settlement of the coke strike and the blowing in of a number of furnaces in the Shenango and Mahoning Valleys, which had been idle since February. The iron market has been quiet, not to say dull, with hardly any change for the last two or three weeks. This state of affairs is in the ordinary course of events, however, as it is the season of suspension of operation at many of the rolling mills. It is the general opinion that business will continue dull at all events until August, and no material improvement is likely to happen before September, when, if the crops fulfill their present promise, a season of activity may be looked for. There has been no change to speak of in prices, but the opinion seems to prevail, in some quarters at least, that values will decline somewhat before a more active period of trade. The general disposition on the part of buyers to hold off corroborates this. At all events there is no expectation of a rise in prices in the next two months. In the local iron market although no great activity was looked for with the termination of the strike of the foundrymen, yet a little stronger demand was anticipated than has as yet materialized. Dealers agree that business is practically as quiet as it was last week, and the general impression is that no change will occur before August. The small number of orders that are being placed are strictly of hand-to-mouth character, buyers filling immediate wants only. They think apparently that there will be no difficulty in securing iron when they need it, and at the present moment it does not seem that they are far from right. Prices are firm at Northern No. 1 X, $17 @ $18; No. 2 X, $16 @ $17; Southern, No. 1 X, $17 @ $18; No. 2 X, $16 @ $17. In spiegeleisen and ferro-manganese the market is decidedly flat. There seems to be no demand for these materials, and we hear of no transactions outside of job lots. Very little ferro-manganese is being imported at present, and the market is evidently in for the general midsummer dullness. Quotations are, nominally, spiegeleisen, 20%, $27.50 @ $28.50; ferro-manganese, 80%, $64.50 @ $65.50.

Cleveland, O., June 25, 1891.—The situation of affairs at present is such that although there are signs of an impending change, no one seems able to decide whether it will be for the better or worse. Perhaps the majority take the former view, although not a few hold to the opinion that the look out is but a dark one. Some ore men are making large sacrifice sales in order to keep their trade, whilst others are holding off for the better prices they anticipate before very long. The pig iron market, although void of improvement in the way of better quotations, is quite firm, and the quantity of iron for sale for future delivery is getting scarcer from day to day, which is a very good sign. The inquiries for iron of all makes is rather lively, and at this rate the chances are more than good for a stiffening in the price.

Copper.—The market has been decidedly firm for some time past;, within the past ten days it has exhibited remarkable strength, both in Europe and the United States. The exports from the latter country have been very heavy, to fill the large demand, especially for lower grades. Hardly any casting copper is now being offered in the American market, what little there is bringing 12 cts. @ 12⅛ cts. Arizona copper is not obtainable at all as better prices are to be had in Europe, and the whole output for some months ahead is contracted for. Lake copper is still procurable in ingots ex-store New York, at 13 cts., but first hands are firm and ask 13½ cts. for future delivery, though no contracts have yet been made on this basis. The Anaconda mine is still shut down and this is now telling heavily on the supplies. Manufacturers are well stocked with orders, but the demand for electrical purposes is not as great as it might be.

English statistics in spite of the heavy receipts show a decrease of 400 tons for the first half of June. The demand both in England and on the continent has been very heavy, both for electrical and general purposes and has steadily reduced stocks, while at the same time prices have risen, G. M. B. copper being more than £4 higher than our quotations last month, being now worth about £56 2s. 6d. @ £56 5s. for spot and £56 12s. 6d. @ $56 15s. for three months. We quote English tough, £58@£58 10s.; best selected, £59@£59 10s.; strong sheets, £66@£67; Indian sheets, £62@£63; yellow metal sheets, 5¾d.@6d.

Lead.—The higher prices that have obtained in the American market had the effect of bringing out more sellers and checking buying to some extent. Consequently of late there has been very little doing, prices being steadily maintained at about 4.40 cts.@4.45cts. with some shading of these prices in some instances to effect sales. St. Louis and Chicago both report a very moderate amount of business at nominally unchanged values, but sellers are having some difficulty in maintaining them. In London Spanish lead is quoted at £12 15s. and English at £13.

Nickel.—There has been an active demand for nickel of late, but hardly any spot is to be had. The imports from Europe into the United States have been very light and the prices are firm and rather higher, 70cts.@75cts. according to quality and brand.

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Speculation in Iron Warrants and its Influence on Legitimate Trade.

(Colliery Guardian).

The promoters of the Pig Iron Warrants Bill could not have or desire more conclusive testimony to the value of and necessity for their measure than the state of the warrant market during the last two months. It has been the sport incontrovertibly of gamblers, pure and simple, who have not a fraction of real interest in the trade itself, and legitimate business has practically been suspended, for it could not be expected that regular buyers would operate when such a wild, uncertain condition of affairs prevailed. In the face of this it is difficult to believe that there should be any opposition to a genuine attempt to restrict or regulate what, it must be conceded, is an unmitigated evil, and has worked incalculable injury to the industry at large. The true interests of the trade would be infinitely better promoted if, by legislation or any other means, such organisations as the London and Glasgow iron "rings" were abolished, for it is nothing short of a grave scandal that the regulation of prices should be taken altogether out of the hands of the producer and consumer, who have a vital interest in them, and given to people who have nothing at all to do with the production, distribution, or consumption of the iron. The ordinary supply of and demand for iron have little to do with the determination of the value of pig iron when the gambling fraternity step in. The speculation has undoubtedly intensified the depression which was in progress when it set in so fiercely, and the legitimate traders who have reaped any good out of the business of the last two months have been few indeed. The paralysis of legitimate trade has told very keenly upon many branches of the iron and steel industries besides the pig iron department, and we hear of works being closed in many parts of the country through lack of orders.

Any improvement in the iron trade must naturally begin with the finished departments, and extend to the pig iron branch; it is out of the question that it should commence with the raw material. But the artificiality of the course of the market during the last two months will be recognised when we state that pig iron warrant prices have gone up 20 per cent. or more, when the legitimate demand for and consumption of pig iron were actually declining, and when business in the finished iron and steel trades was falling off. The present situation has been brought about in this wise. When the Scotch blast-furnacemen's strike, which lasted from October to March, was ended by the men abandoning their cliam for extra pay for Sunday work and accepting 20 per cent. reduction of wages, the Scotch pig iron makers began to blow in their furnaces. Naturally the Glasgow "bears" inferred that an increased production of pig iron coming with a decreased consumption of it would lead to lower prices, and they commenced to sell very heavily, at the current rates, warrants which they had not got, and which they put off buying while they forced prices down. They made a determined onslaught upon these, and without doubt depressed the quotations for warrants much more than the actual state of the trade really justified. They neglected buying to cover their sales until there appeared no chance of running down the value of warrants and further. But here they were finely caught, for when the time came for them to deliver the iron they had sold, and when it was absolutely necessary that they should buy without more delay, they found they could not get the iron they needed. When they were recklessly selling, the London "bulls," who are reputed to be very wealthy individuals, bought up large quantities of Scotch warrants, and when the Scotch "bears" were compelled to buy they had to pay pretty nearly whatever price the London operators chose to ask, for these latter were undoubtedly the masters of the situation. They have made the "bears" smart more severely than they have for years past. Very heavy losses among them have been the consequence; in fact, it is contended that by the late deals the Glasgow people have dropped over a quarter of a million sterling, and some failures among the speculators have followed, with others in prospect. The establishment of the London iron market has thus proved more detrimental to the operations of the Glasgow "bears" than the latter ever expected it would; it has prevented them having it all their own way in the matter of regulating prices, as they had been accustomed to have. These London operators appear to have got the measure of the Scotch "bears," and know just how much they can be "squeezed;" they therefore do not force up prices as high as they might, because, if they did, the "bulls" might themselves be losers, for while they might get the heavy differences out of a few of the sounder "bears," they would drive the weaker fraternity into the bankruptcy courts, and secure nothing from them, for debts of this kind are not recoverable at law. The "bears" had their innings till the first week in April, the 6th being the day of the minimum prices, when Scotch pig iron warrants were down at 42s. 2½d., hæmatite at 46s. 7d., and Middlesbrough at 37s. 7½d. Then it was that the "bulls" found that their opportunity had come, and since that day they have sold Scotch warrants at 54s. 3d. cash, hæmatite at 53s. 9d. and Middlesbrough at 42s. 9d.—advances of 12s. 0½d., 7s. 2d. and 5s. 1½d. respectively.

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CONSULTING MINING ENGINEER.

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NORTH-WEST MOUNTED POLICE

RECRUITS.

APPLICANTS must be between the ages of Twenty-two and Forty, active, able-bodied men of thoroughly sound constitution, and must produce certificates of exemplary character and sobriety.

They must understand the care and management of horses, and be able to ride well.

The minimum height is five feet eight inches, the minimum chest measurement 35 inches, and the maximum weight 175 pounds.

The term of engagement is five years.

The rates of pay are as follows:—

Staff-Sergeants............$1.00 to $1.50 per day.
Other Non-Com. Officers .. 85c. to 1.00 do

	Service pay.	Good conduct pay.	Total.	
1st year's service..	50c.	——	50c.	per day.
2nd do ..	50c.	5c.	55c.	do
3rd do ..	50c.	10c.	60c.	do
4th do ..	50c.	15c.	65c.	do
5th do ..	50c.	20c.	70c.	do

Extra pay is allowed to a limited number of Blacksmiths, carpenters and other artizans.

Members of the force are supplied with free rations, a free kit on joining, and periodical issues during the term of service.

Applicants may be engaged at the Immigration office, Winnipeg, Manitoba; or at the Headquarters of the Force Regina N. W. T.

The Position of Copper.

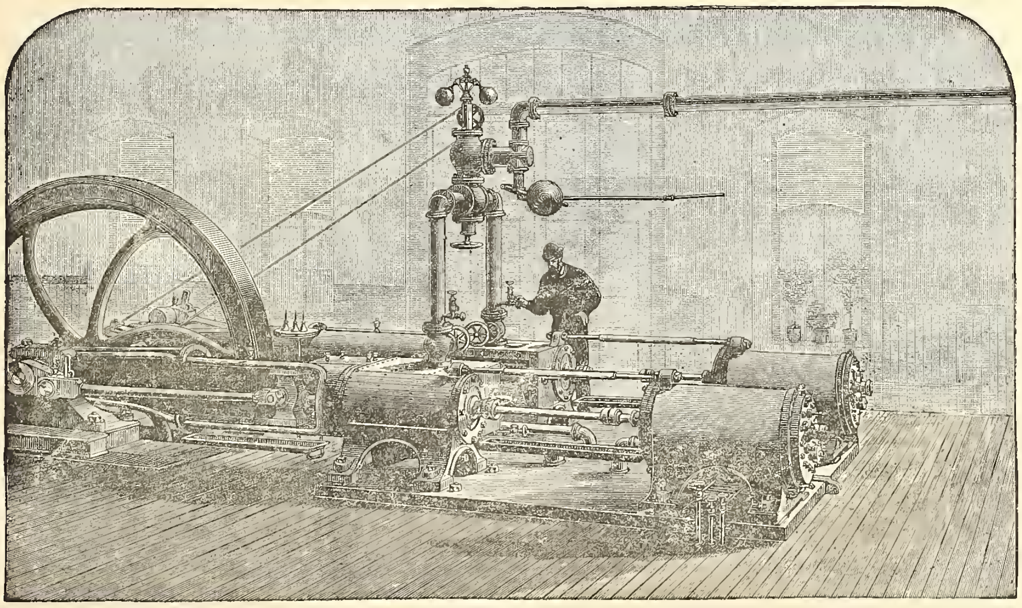
The statistical position of copper appears to be so strong—on paper at all events—that the rise in values is not at all surprising. Were we positive that the published statistics include all the copper on hand the position would be clearer and might be stronger. As a matter of fact it is not shown in a definite form that the remnants of the stock of the late French syndicate and its allies are included, consequently the market is being influenced in an upward direction, while the very important question of the syndicate stock is either overlooked or left out of account as being of no moment. Taking the figures as they stand, however, it is undeniable that they make what the Americans term "a good showing" for higher prices. Deliveries seem to be in excess of the current supplies, and stocks (always presuming that these *do* inclnde the French ring's remnants) are lower than for some years past. The following figures, taken from Merton & Co.'s returns, establish these points conclusively:—

—	Supplies.	Deliveries.	Stocks.	Price of G. M. B.		
1891—	Tons.	Tons.	Tons.	£	s.	d.
May..	9,672	11,180	57,808	55	5	0
April.......	12,227	11,264	59,316	51	12	6
March......	9,284	9,962	58,353	53	2	6
February....	7,105	8,670	59,031	52	15	0
January	7,494	12,264	60,596	52	12	6
1890—						
December ..	11,807	11,881	65,366	52	10	0
November ...	8,445	11,230	65,440	55	7	6
October.....	8,525	10,206	68,225	58	7	6
September ..	10,187	10,240	69,906	59	10	0
August	9,393	11,967	69,959	60	5	0
July........	11,470	11,430	72,533	57	0	0
June.... ...	9,233	18,781	72,498	58	10	0
Totals	114,842	139,075	....	......		
1889—						
May 3......	....	....	117,420	41	0	0
1888—						
June 30.....	....	....	72,243	70	0	0

It should be noted that the Chili charters for the month of May are estimated at 800 tons. This may or may not be near the truth—probably it is a close approximation to the actual facts—but it must not be overlooked that the charters from Chili average over 2,000 tons monthly, and

THE CANADIAN RAND DRILL COMPANY,

SHERBROOKE, QUE.



THE ABOVE CUT illustrates our DUPLEX AIR COMPRESSOR, which in the United States has become the Standard Machine for permanent plants where economy of fuel is sought.

We also build Straight Line Compressors—the best of their class—for Contractors' use and for Exploration work where low first cost and semi-portability outweigh considerations of economy of fuel.

All our Compressors are now fitted with our positive-motion Air-Valves, the only real improvement that has ever been made over the old Spring Valves.

in April reached as high as 3,650 tons. The shortage in May, therefore, may be expected to be made up in June or July, despite the disturbance of the Chilian mining industries caused by thecivil war in that country. But the leading reliance of those who look for a further rise in prices is upon the cessationo f production at the Anaconda mine in the United States. Probably they will be somewhat less sanguine of the future if it proves to be true that the Anaconda may start up again this month or in July, so soon as its new electrolytic plant is in working order. The restarting of that great mine would necessarily add to the available supplies. Meantime it is noticeable that exports of copper from the United States have been excceedingly heavy since the beginning of 1891. In the first four months of the year they amounted to 19,871 tons of fine copper (about half in ingot, bar, &c., and the other half in matte) or equal to about 80 per cent. of the total exports of 1890. This would seem to show that the prices lately prevalent suit the American producers, hence it is only fair to infer that the higher prices will stimulate the output even more than heretofore. That effect will follow, indeed, all over the world, and in due course will be likely to defeat the objects of those who are said to have once more taken in hand "copper for a raise." No definite information on this point is available, but it is alleged that the new movement is being promoted from Paris, and that it has for its main object the pushing up of Rio Tinto shares. It is even stated that M. Secrétan is one of the leaders of the movement. On the other hand, it is asserted that the copper "bulls" are located in London, and are identical with those who have effected the upward move in Scotch pig iron warrants. From a legitimate trade standpoint it is not very material who the speculators may be. If they attempt to go too fast or too far they will inevitably bring about their own destruction. They may succeed in manipulating values for a time, but if they push prices beyond, say 60*l*. a ton, they will at one and the same time diminish consumption and promote production all over the world.—*Ironmonger.*

Sand-Moulding Machine.—An illustration is given in *Industries* of a sand-moulding machine. The pattern is formed or fitted on the upper and lower side of a plate which swings and slides on one of the pillars. The mould is formed in sand contained in two flasks, one above, the other below the pattern plate. The base of the machine carries two hydraulic rams, one inside the other. The plate on the outer ram head serves to lift the boxes and to compress the sand, while the inner ram ejects the mould from the flask. In operation the pattern plate is swung clear, the lower box is filled and the plate is swung back. The upper box is then lowered on to it and filled with sand. The boxes and plate are then lifted up to the top of the machine, where the sand is compressed against the top plate. The boxes are then dropped and separated, the pattern is swung out, and the boxes are again brought together, so that the inner ram may expel the mould.

SUDBURY NICKEL LANDS

FOR SALE

A FIRST-CLASS INVESTMENT.

Several very valuable locations containing rich deposits of Nickel and Copper Ore, situate in the Townships of Moncrieff and Craig, in the Sudbury Mining District, Province of Ontario.

Mr. J. R. Gordon, C.E., who spent most of the season of 1890 investigating the nickel deposits in the vicinity of Straight Lake, a station on the main line of the Canadian Pacific Railway, about 47 miles west of Sudbury, reports very favorably of these properties. The deposits extend from about one mile north-east of the railway to about four miles southwest. Where the lode crosses the track in the Township of Moncrieff, the vein or deposit of nickel is nearly 20 feet wide. The vein varies in width from 10 to 20 feet, but in places is over 30 feet wide. At the western terminus of the lode in the Township of Craig, which is immediately west of the Township of Moncrieff, the width increases.

The Huronian rocks have been traced by Dr. Robert Bell, of the Geological Survey of Canada, for a distance of some three miles west of the Spanish River, and to South and West are gneiss formations.

In his paper published in the bulletin of the Geological Society of America, Dr. Bell describes this district "The Geneva Lake Outlier."

Plans, Experts' reports, and full particulars may be had by addressing

J. M. CLARK,
27 Wellington Street East, Toronto.

OR

W. A. CLARK,
Agent Dominion Express Co., Ottawa.

FOR SALE.

The following first-class Phosphate lands in Templeton, P.Q :

	Lot	Con.	acres
West ½ of Lot	8, 10th	Con.,	100 acres.
South ½	" 16, 10th	"	100 "
	" 11, 12th	"	215 "
	" 12, 12th	"	190 "
South pt.	" 13, 12th	"	50 "
North "	" 21, 12th	"	147 "
	" 11, 13th	"	161 "
	" 12, 13th	"	132 "
	" 17, 13th	"	47 "
			1142 acres.

These lands are held in absolute fee simple under Crown Patents. In addition to phosphate they contain many other minerals, among which may be mentioned ASBESTOS, MICA and BARYTES. As will be observed, most of the lots are in fairly close proximity, and they adjoin, or are actually traversed by a good county road, affording easy transit to the East Templeton Railway Station and Wharves on the Ottawa River. After personal examination Sir William Dawson, LL.D., F.R.S., F.G.S., the eminent Geologist, reported regarding this property: "In my opinion it has been very judiciously selected both with reference to probable yield of phosphate and facility of transport."

Application may be made to

Mr. L. Marcellais,
Perkins' P.O.,
East Templeton, P.Q.

Or to Mr. A. T. Paterson,
Box 2002, Montreal.

JUDICIAL SALE

OF A

MINERAL LOCATION in the District of Thunder Bay,

Ontario, Canada.

Pursuant to the order of the Chancery Division of the High Court of Justice for Ontario, there will be sold by public auction with the approbation of the Master in Ordinary, by Wm. H. Hewson, Auctioneer, at the Northern Hotel in the Town of Port Arthur, on Monday, the 6th day of July, 1891, at 12 o'clock, noon, the following lands and premises: The Mineral Location known as Block "A" on Current River, in the Township of McIntyre in the said district of Thunder Bay, containing by admeasurement 400 acres more or less.

The above property is situated on Thunder Bay, at the head of Lake Superior, and is withinthree miles of the Town of Port Arthur.

There is water power on the property, the Current River running through the centre of the lot.

For further particulars and terms of sale apply to,

BRUCE, BURTON & BRUCE,
Barristers,
May 16th, 1891. Hamilton, Ont.

Money Orders.

MONEY ORDERS may be obtained at any Money Order Office in Canada, payable in the Dominion and Newfoundland; also in the United States, the United Kingdom, France, Germany, Austria, Hungary, Italy, Belgium, Switzerland, Portugal, Sweden, Norway, Denmark, the Netherlands, India, Japan, the Australian Colonies, and other Countries and British Colonies generally.

On Money Orders payable within Canada, the commission is as follows:

If not exceeding $4	2c.
Over $4, not exceeding $10	5c.
" 10, " " 20	10c.
" 20, " " 40	20c.
" 40, " " 60	30c.
" 60, " " 80	40c.
" 80, " " 100	50c.

On Money Orders payable abroad the commission is:

If not exceeding $10	10c.
Over $10 not exceeding $20	20c.
" 20 " " 30	30c.
" 30 " " 40	40c.
" 40 " " 50	50c.

For further information see OFFICIAL POSTAL GUIDE.

Post Office Department, Ottawa.
1st November 1889.

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Iron, Steel, Pipe, Valves, Fittings, Rope, Chains, Rails, Tools.

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Hauling Machinery in Cumberland.—Mr. C. M. Percy has just completed a very full inspection of the underground hauling appliances at the extensive collieries of the Whitehaven Colliery Company in Cumberland, the principal proprietor of which is Sir James Bain, M.P. The coal is all under the sea. The present workings are three miles out, and the firm have powers to work the coal to a considerably greater distance. The gradient is all against the load, and under such circumstances the underground conveyance is an all-important matter. The system at all the collieries is endless rope, with steam engines stationed on the surface. The coal being worked is of high quality and of substantial thickness, and constitutes the chief industry in Whitehaven.

TENDERS FOR COAL.

SEALED TENDERS addressed to the undersigned, and endorsed "Tender for Coal," will be received at this office until Tuesday, the 14th day of July next, for the supply and delivery at Sorel, Quebec, of 3,400 gross tons (2,240 lbs.) of best steam coal, freshly mined and well screened before loading, as the "run of the mine" will not under any circumstances be accepted.

Tenders to state the name of the mines and quality of coal offered, and the price per ton delivered on the wharf at Sorel.

Each tender must be accompanied by an accepted bank cheque for the sum of $550, not limited as to time of payment, made payable to the order of the Honourable the Minister of Public Works, which will be forfeited if the party decline to enter into a contract when called on to do so, or if he fails to deliver the quantity contracted for. If the tender be not accepted the cheque will be returned.

By order,
E. F. E. ROY,
Secretary.

Department of Public Works,
Ottawa, June 24th, 1891.

SEALED TENDERS addressed to the undersigned, and endorsed "Tender for Coal, Public Buildings," will be received until Thursday, 23rd July next, for all or any of the Dominion Public Buildings.

Specification, form of tender, and all necessary information can be obtained at this Department on and after Monday, 29th June.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures.

Each tender must be accompanied by an accepted bank cheque made payable to the order of the Honorable the Minister of Public Works, *equal to five per cent.* of the amount of the tender, which will be forfeited if the party decline to enter into a contract when called upon to do so, or if he fail to supply the coal contracted for. If the tender be not accepted the cheque will be returned.

The Department will not be bound to accept the lowest or any tender.

By order,
E. F. E. ROY,
Secretary.

Department of Public Works,
Ottawa, June 24th, 1891.

A New Specimen.—A distinguished professor was lecturing one day on mineralogy. He had before him a number of specimens of various sorts to illustrate the subject; but a roguish student for sport slyly slipped a piece of brick among the stones. The professor was taking these up one after another and naming them. "This," he said "is a piece of granite. This is a piece of felspar," &c. Presently he came to the brickbat. Without betraying any surprise or even changing the tone of his voice, he said, "This, gentleman, is a piece of impudence."

The Purification of Blast Furnace Gas.—The "Cyclone" dust-collector has been in use in Germany for some time past. The gas from which the dust is to be deposited is subjected in this machine to a rapid centrifugal motion. The effect of this is to throw the dust against the casing of the machine, whence it falls through a hole in the inverted conical base, the gas passing out at the top. The machine gives good results, is simple in construction, and needs no watching.

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—DOMINION AND PROVINCIAL—
LAND = SURVEYORS,
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OTTAWA, ONT.

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Mines and Mining Lands. ☜

TORONTO MINING
ASSOCIATION,
[LIMITED].
§

This Association is established to form a centre of information on all matters pertaining to Mining, and a suitable place where specimens may be received and examined.

It is intended to collect in the rooms of the Association specimens of all merchantable Canadian Minerals, with particulars as to place of deposit, and other information which may be useful both from a scientific and merchantable point of view. With this object the Association has decided to open rooms in Toronto within the next few weeks, where information can be sent and obtained, of Mining Properties for sale, and the undersigned has been appointed Managing Director.

The Stock Books of the Association are now open, and mining men and parties having mining properties to dispose of in all parts of the Province are invited to become members of the Association and to send information regarding their properties.

A person can become a member by subscribing for one share of $10 and by paying an annual membership fee of $4.

Further particulars can be obtained by applying to the undersigned,

A. S. THOMPSON,
Managing Director,
Cor. Victoria & Lombard Sts., Toronto.

No. 3 blast furnace of the Phœnix Works at Berge-Borbeck has recently been blown-out after what is claimed to be the longest blast on record on one lining. It was blown-in on March 31, 1873, and was in blast until July 15, 1890. During this period of over seventeen years it made 355,236 tons of pig iron. The dimensions are: Height, 49 feet and 5 inches; diameter at the boshes, 16 feet. Until within a year of the termination of the blast iron-pipe stoves were used; since then two Cowper stoves have been erected, and the furnace has made 80 tons of pig iron a day.

PROVINCE OF NEW BRUNSWICK.

Synopsis of "The General Mining Act," Chapter 16, 54th Victoria.

—LEASES FOR MINES OF—

GOLD, SILVER, COAL,
IRON, COPPER, LEAD,
TIN and PRECIOUS STONES.

GOLD AND SILVER.

PROSPECTING LICENSES up to 100 areas, (each 150 feet by 250 feet), issued at 50 cts. an area up to 10 areas, and 25 cts. afterwards per area, good for one year. These Licenses can be renewed for second year, by payment of one half above amount.

LEASES for 20 years to work and mine, on payment of $2 an area of 150 feet by 250 feet. Renewable annually at 50 cts. an area in advance.

Royalty on Gold and Silver, 2½ per cent.

MINES, OTHER THAN GOLD AND SILVER.

LICENSES TO SEARCH, good for one year, $20 for 5 square miles. Lands applied for must not be more than 2½ miles long, and the tract so selected may be surveyed on the Surveyor General's order at expense of Licensee, if exact bounds cannot be established on maps in Crown Land Office. Renewals for second year may be made by consent of Surveyor General, on payment of $20.

Second Rights to Search can be given over same ground, subject to party holding first Rights, on payment of $20.

LEASES.—On payment of $50 for one square mile, good for two years, and extended to three years by further payment of $25. The lands selected must be surveyed and returned to Crown Land Office. Leases are given for 20 years, and renewable to 80 years. The Surveyor General, if special circumstances warrant, may grant a Lease larger than one square mile, but not larger than two square miles.

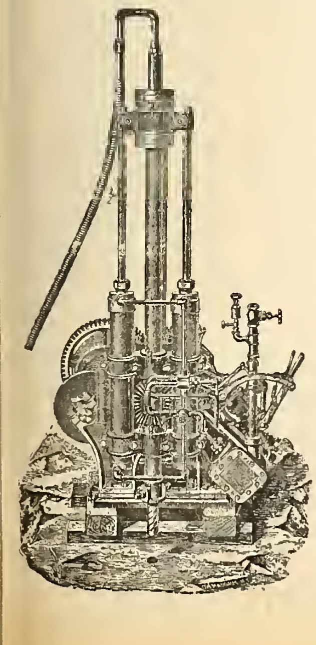
ROYALTIES.

Coal, 10 cts. per ton of 2,240 lbs.
Copper, 4 cts. on every 1 per cent. in a ton of 2,352 lbs.
Lead, 2 cts. on every 1 per cent. in a ton of 2,240 lbs.
Iron, 5 cts. per ton of 2,240 lbs.

Tin and Precious Stones, 5 per cent. of value.

APPLICATIONS can be fyled at the Crown Land Office each day from 9.30 a.m. to 4.30 p.m., except Saturday, when Office closes at 1 p.m.

L. J. TWEEDIE,
Surveyor General.



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For prospecting Mineral Veins and Deposits, Boring Vertically, Horizontally or at any angle, to any desired depth, taking out a Cylindrical Section or Core the entire distance, showing exact character, and giving a perfect section of the strata penetrated. Also for Boring Artesian Wells perfectly straight, round and true.

Machines for Channelling, Gadding, and all kinds of Quarry Work, Shaft Sinking, Tunnelling, Mining, Railroad, and all classes of Rock-Boring.

THE "DIAMOND DRILL" Received the Highest Award at the CENTENNIAL EXHIBITION
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It has also received the highest awards at the AMERICAN INSTITUTE FAIR, New York, and the FRANKLIN INSTITUTE FAIR, of Philadelphia, Pa.

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OF CANADA.

The direct route between the West and all points on the Lower St. Lawrence and Baie des Chaleur, Province of Quebec; also for New Brunswick, Nova Scotia, Prince Edward and Cape Breton Islands, Newfoundland and St. Pierre.

EXPRESS TRAINS leave Montreal and Halifax daily (Sunday excepted) and run through without change between these points in 30 hours.

The Through Express Train cars of the Intercolonial Railway are brilliantly lighted by electricity and heated by steam from the locomotive, thus greatly increasing the comfort and safety of travellers.

New and Elegant Buffet Sleeping and Day Cars are run on all through Express Trains.

CANADIAN EUROPEAN MAIL AND PASSENGER ROUTE.

Passengers for Great Britain or the Continent by leaving Montreal on Friday morning will join Outward Mail Steamer at Halifax the same evening.

The attention of shippers is directed to the superior facilities offered by this route for the transport of flour and general merchandise intended for the Eastern Provinces and Newfoundland; also for shipments of grain and produce intended for the European market.

Tickets may be obtained and all information about the route, also Freight and Passenger rates, on application to

G. W. ROBINSON,
Eastern Freight and Passenger Agent,
136½ St. James Street, MONTREAL.

E. KING,
Ticket Agent,
27 Sparks Street, OTTAWA.

Railway Offices, Moncton, N.B., 14th November, 1889.
D. POTTINGER, Chief Superintendent.

MAP
—OF THE—
Phosphate Region
—OF—
OTTAWA COUNTY, QUEBEC.

PRICE, TWO DOLLARS.

On sale only at the Offices
OF THE
CANADIAN MINING REVIEW,
OTTAWA.

MINING REGULATIONS

TO GOVERN THE DISPOSAL OF DOMINION LANDS CONTAINING MINERALS, OTHER THAN COAL, 1890.

THESE REGULATIONS shall be applicable to all Dominion Lands containing gold, silver cinnabar, lead, tin, copper, petroleum, iron or other mineral deposits of economic value, with the exception of coal.

Any person may explore vacant Dominion Lands not appropriated or reserved by Government for other purposes, and may search therein either by surface or subterranean prospecting for mineral deposits, with a view to obtaining under the Regulations a mining location for the same but no mining location or mining claim shall be granted until the discovery of the vein, lode or deposit of mineral or metal within the limits of the location or claim.

QUARTZ MINING.

A location for mining, except for iron or petroleum, on veins, lodes or ledges of quartz or other rock in place, shall not exceed 1,500 ft. in length and 500 ft. in breadth. Its surface boundary shall be four straight lines, the opposite sides of which shall be parallel, except where prior locations would prevent, in which case it may be of such a shape as may be approved of by the Superintendent of Mining.

Any person having discovered a mineral deposit may obtain a mining location therefor, in the manner set forth in the Regulations which provides for the character of the survey and the marks necessary to designate the location on the ground.

When the location has been marked conformably to the requirements of the Regulations, the claimant shall within sixty days thereafter, file with the local agent in the Dominion Land Office for the district in which the location is situated, a declaration or oath setting forth the circumstances of his discovery, and describing, as nearly as may be, the locality and dimensions of the claim marked out by him as aforesaid; and shall, along with such declaration, pay to the said agent an entry fee of FIVE DOLLARS. The agent's receipt for such fee will be the the claimant's authority to enter into possession of the location applied for.

At any time before the expiration of FIVE years from the date of his obtaining the agent's receipt it shall be open to the claimant to purchase the location on filing with the local agent proof that he has expended not less than FIVE HUNDRED DOLLARS in actual mining operations on the same; but the claimant is required, before the expiration of each of the five years, to prove that he has performed not less than ONE HUNDRED DOLLARS' worth of labour during the year in the actual development of his claim, and at the same time obtain a renewal of his location receipt, for which he is required to pay a fee of FIVE DOLLARS.

The price to be paid for a mining location shall be at the rate of FIVE DOLLARS PER ACRE, cash, the sum of FIFTY DOLLARS extra for the survey of the same.

No more than one mining location shall be granted to any individual claimant upon the same lode or vein.

IRON AND PETROLEUM.

The Minister of the Interior may grant a location for the mining of iron or petroleum, not exceeding 160 acres in area which shall be bounded by north and south and east and west lines astronomically, and its breadth shall equal it in length. Provided that should any person making an application purporting to be for the purpose of mining iron or petroleum thus obtain, whether in good faith or fraudulently, possession of a valuable mineral deposit other than iron or petroleum, his right in such deposit shall be restricted to the area prescribed by the Regulations for other minerals, and the rest of the location shall revert to the Crown for such disposition as the Minister may direct.

The regulations also provide for the manner in which stone quarries may be acquired.

PLACER MINING.

The Regulations laid down in respect to quartz mining shall be applicable to placer mining as far as they relate to entries, entry fees, assignments, marking of localities, agents' receipts, and generally where they can be applied.

The nature and size of placer mining claims are provided for in the Regulations, including bar, dry, bench, creek or hill diggings, and the RIGHTS AND DUTIES OF MINERS are fully set forth.

The Regulations apply also to

BED-ROCK FLUMES, DRAINAGE OF MINES AND DITCHES.

The GENERAL PROVISIONS of the Regulations include the interpretation of expressions used therein; how disputes shall be heard and adjudicated upon; under what circumstances miners shall be entitled to absent themselves from their locations or diggings, etc., etc.

THE SCHEDULE OF MINING REGULATIONS

Contains the *forms* to be observed in the drawing up of all documents such as:— "Application and affidavit of discoverer of quartz mine." "Receipt for fee paid by applicant for mining location." "Receipt for fee on extension of time for purchase of a mining location." "Patent of a mining location." "Certificate of the assignment of a mining location." "Application for grant for placer mining and affidavit of applicant." "Grant for placer mining." "Certificate of the assignment of a placer mining claim." "Grant to a bed-rock flume company." "Grant for drainage." "Grant of right to divert water and construct ditches."

Since the publication, in 1884, of the Mining Regulations to govern the disposal of Dominion Mineral Lands the same have been carefully and thoroughly revised with a view to ensure ample protection to the public interests, and at the same time to encourage the prospector and miner in order that the mineral resources may be made valuable by development.

COPIES OF THE REGULATIONS MAY BE OBTAINED UPON APPLICATION TO THE DEPARTMENT OF THE INTERIOR.

A. M. BURGESS,
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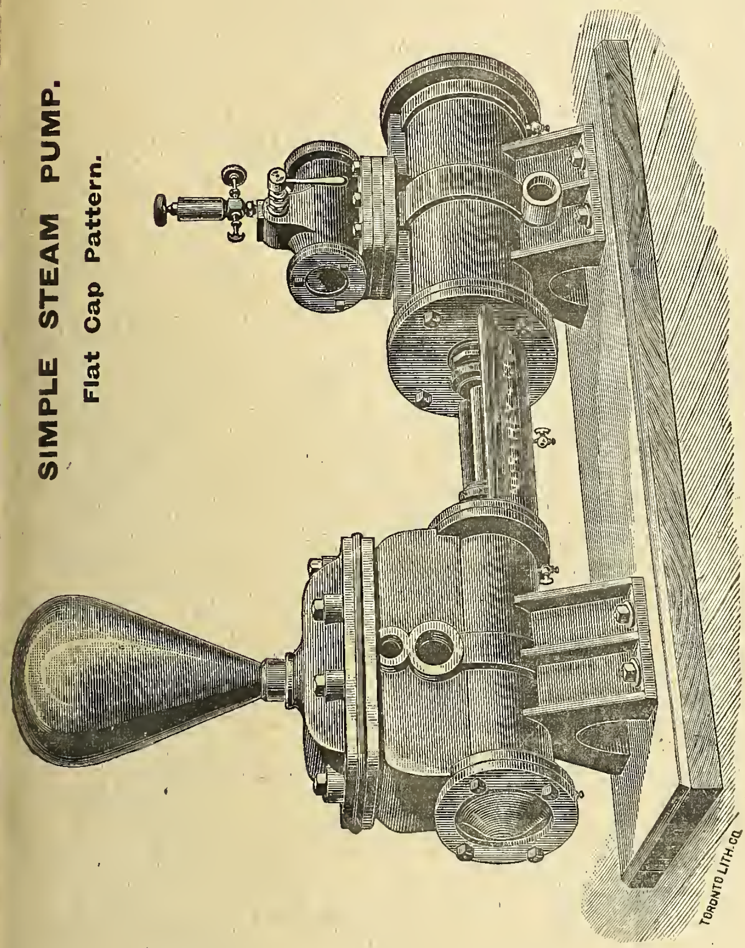
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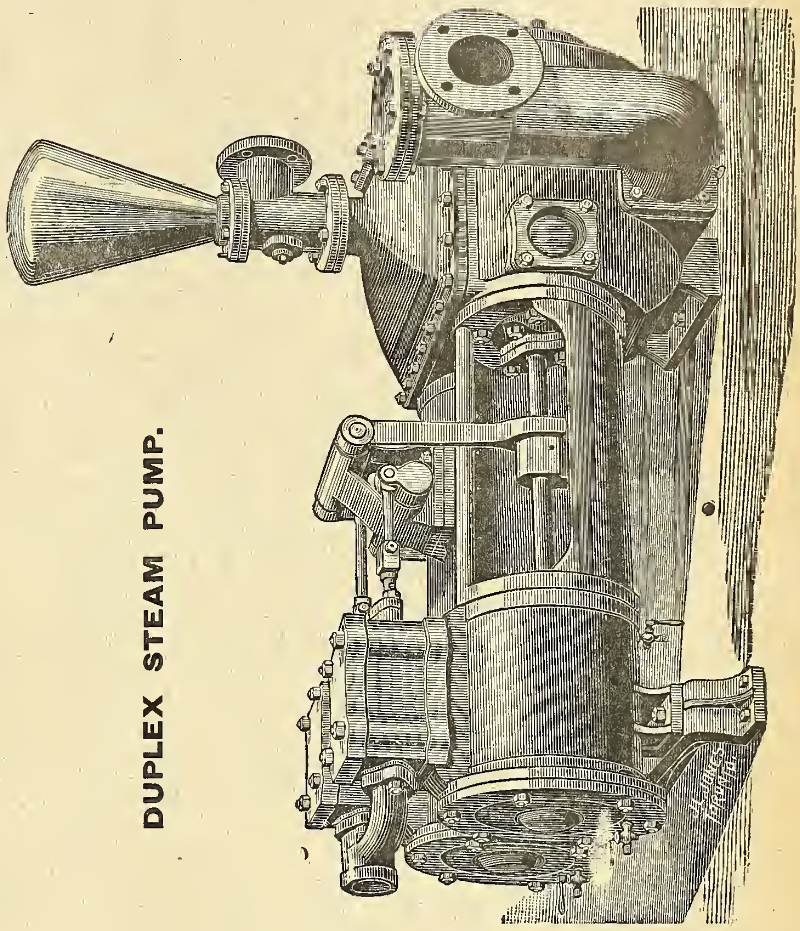

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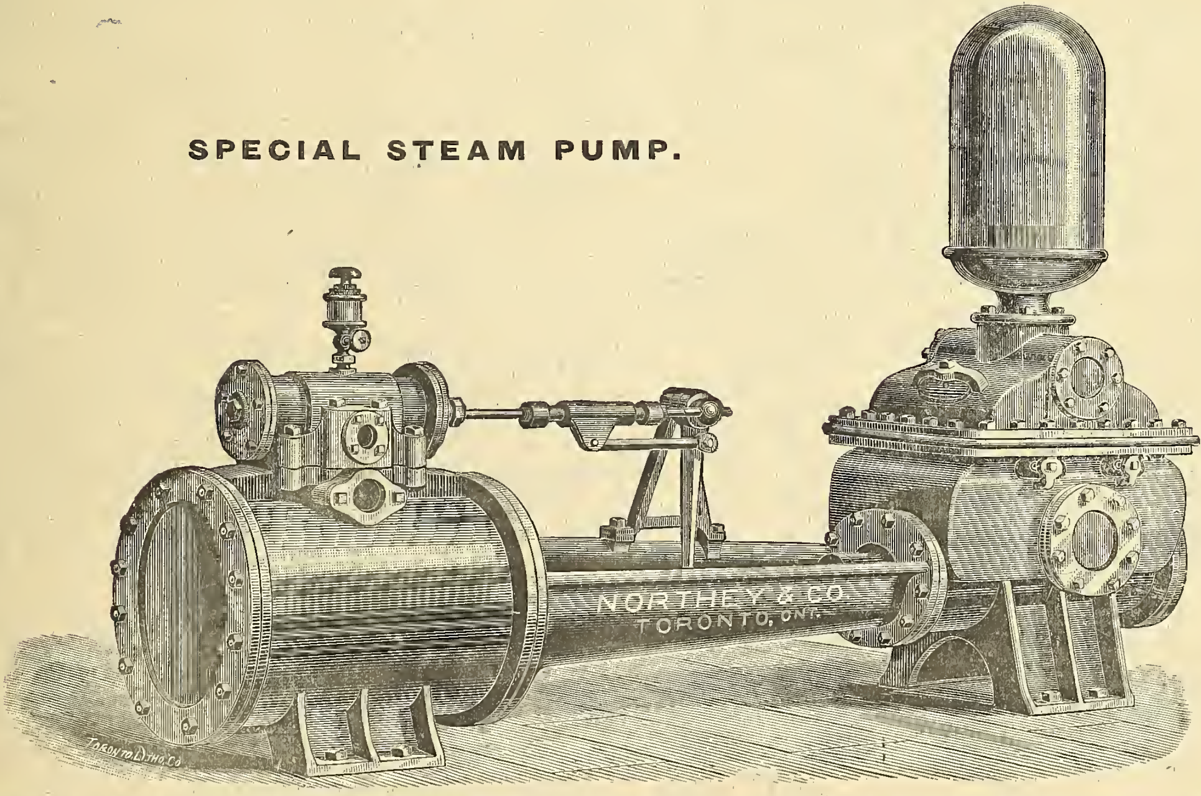
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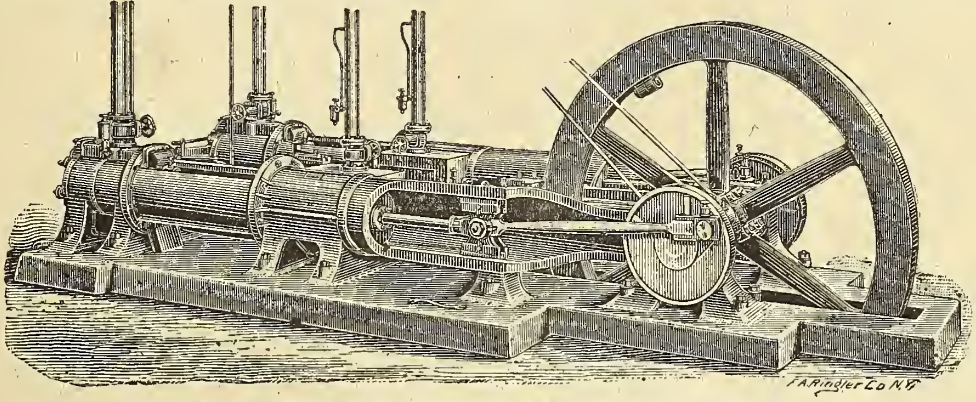
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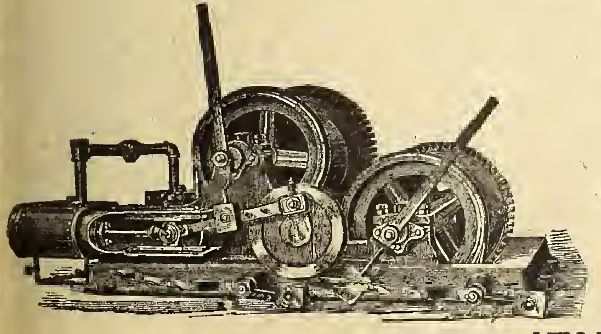

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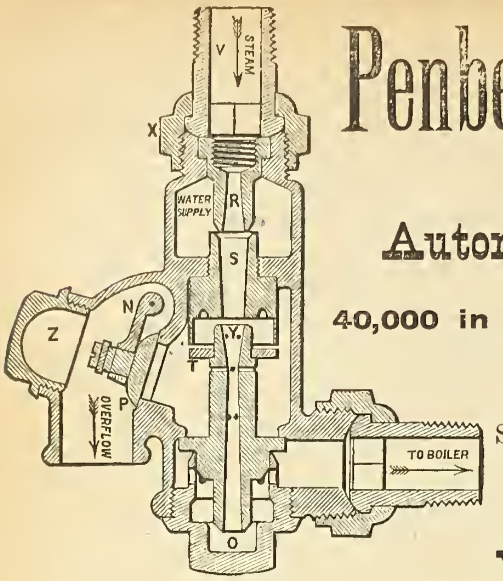

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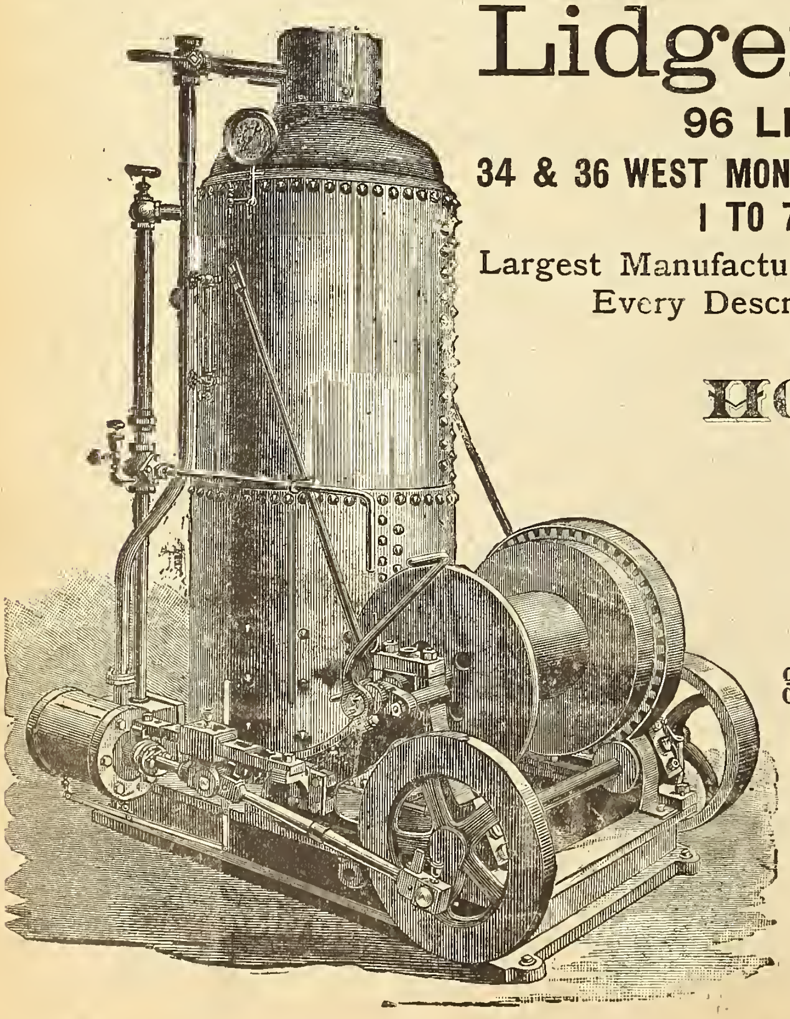

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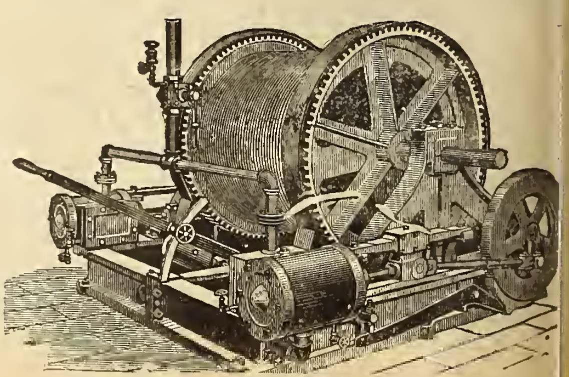

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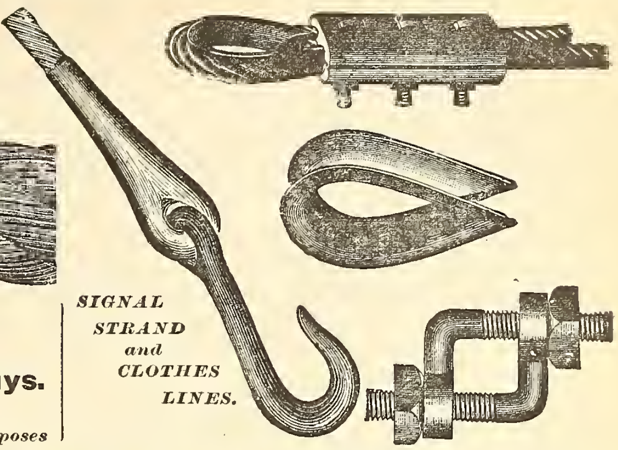

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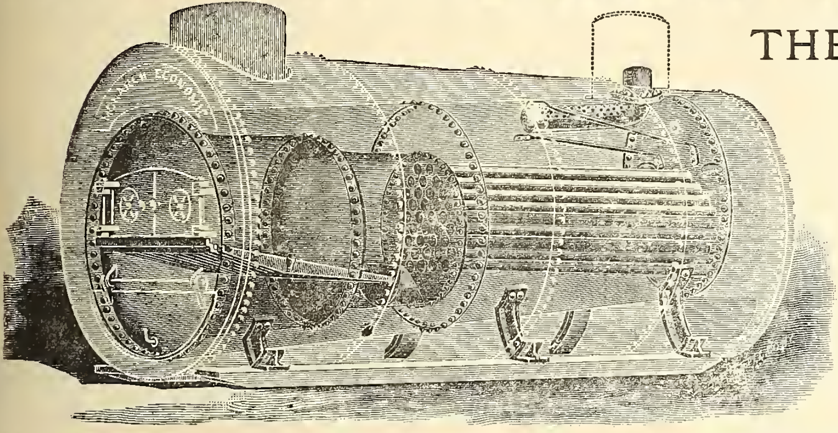

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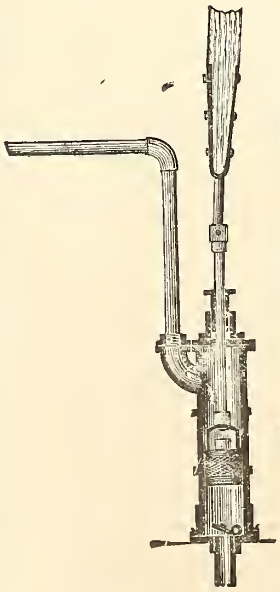

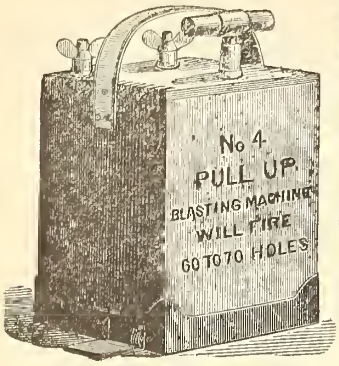

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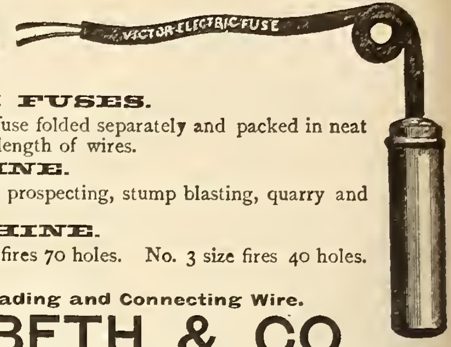

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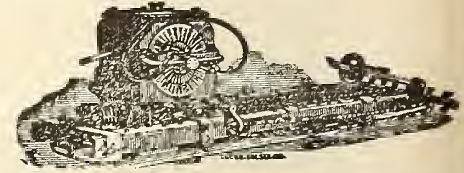

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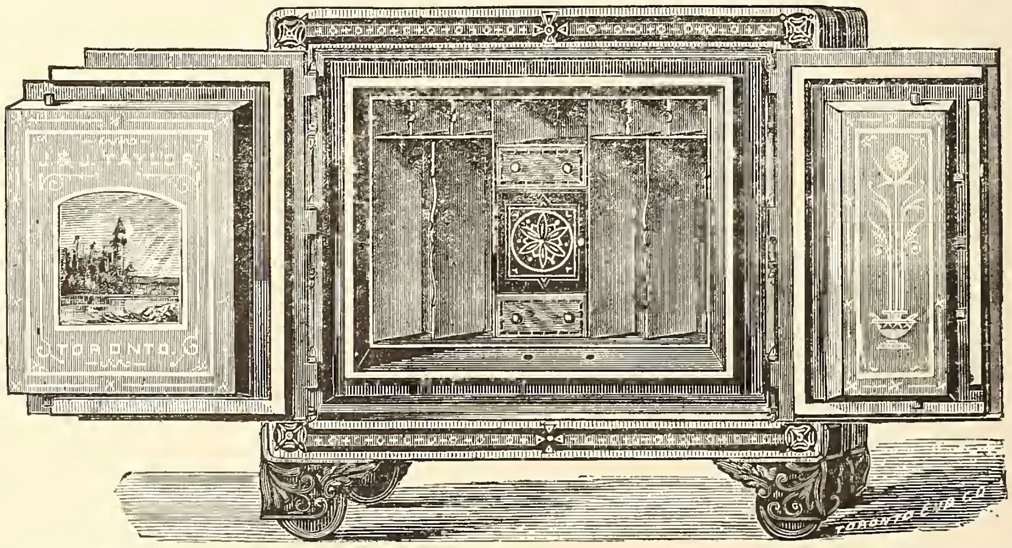

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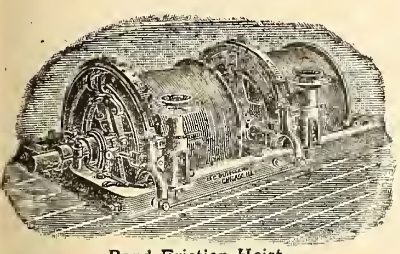

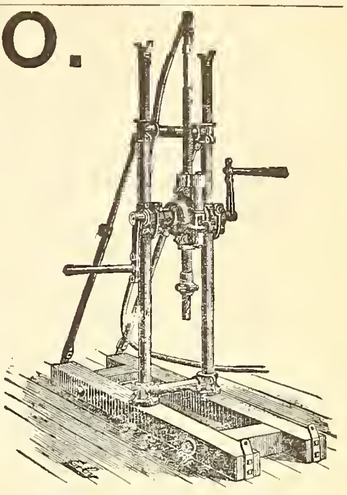

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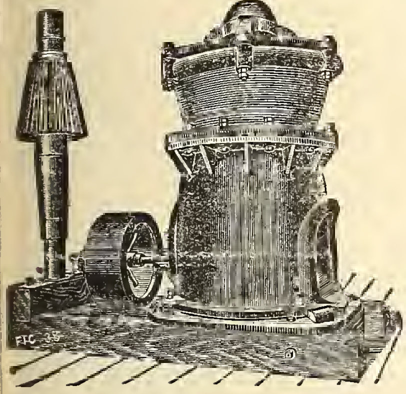

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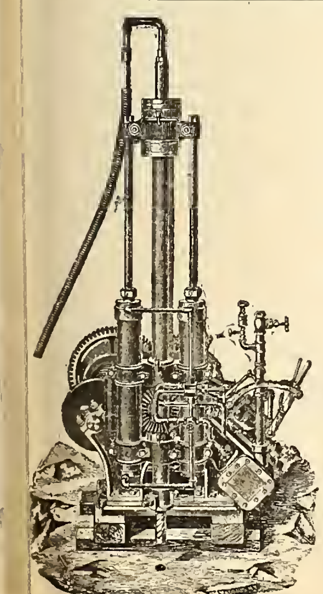

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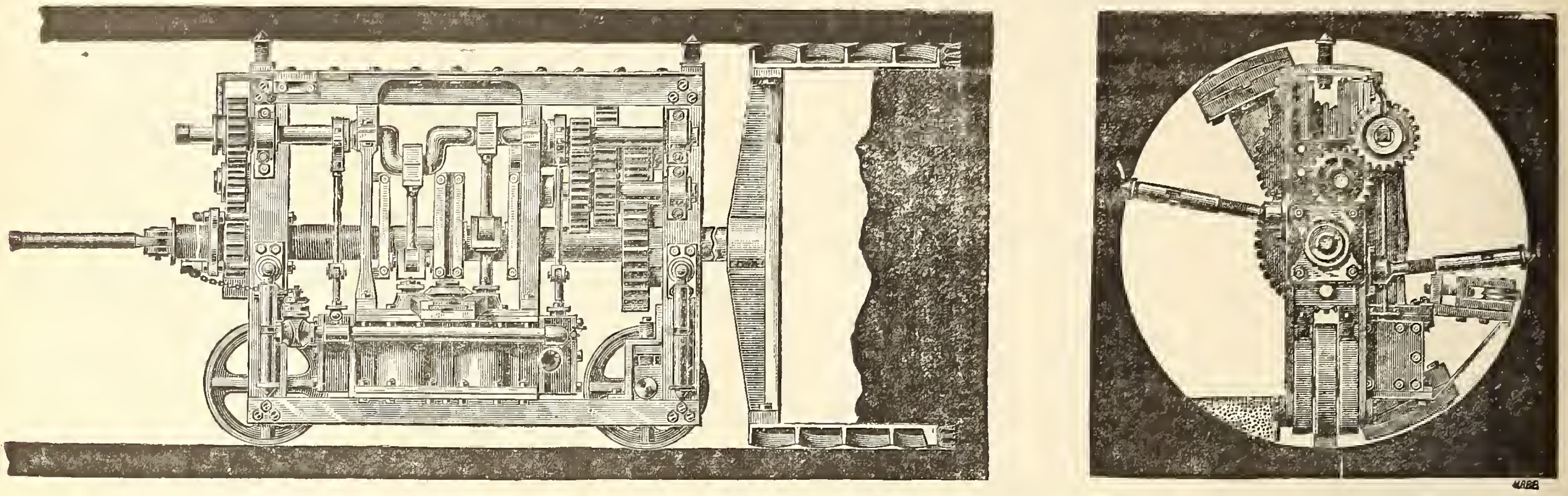

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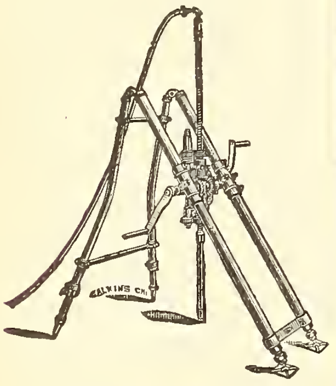

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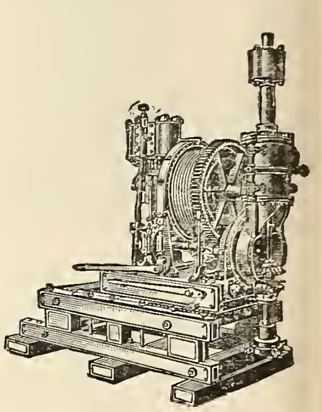

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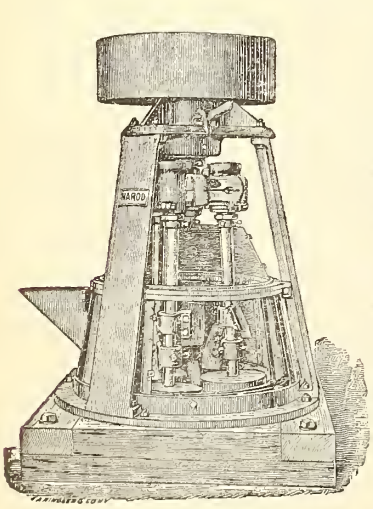

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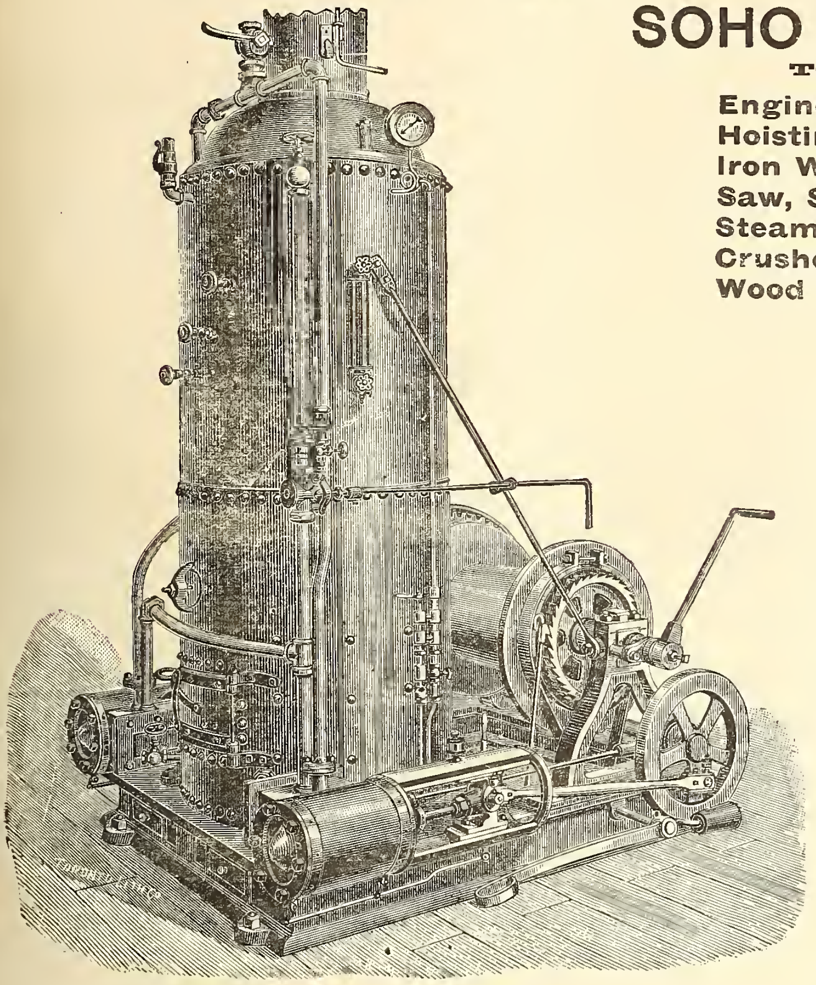

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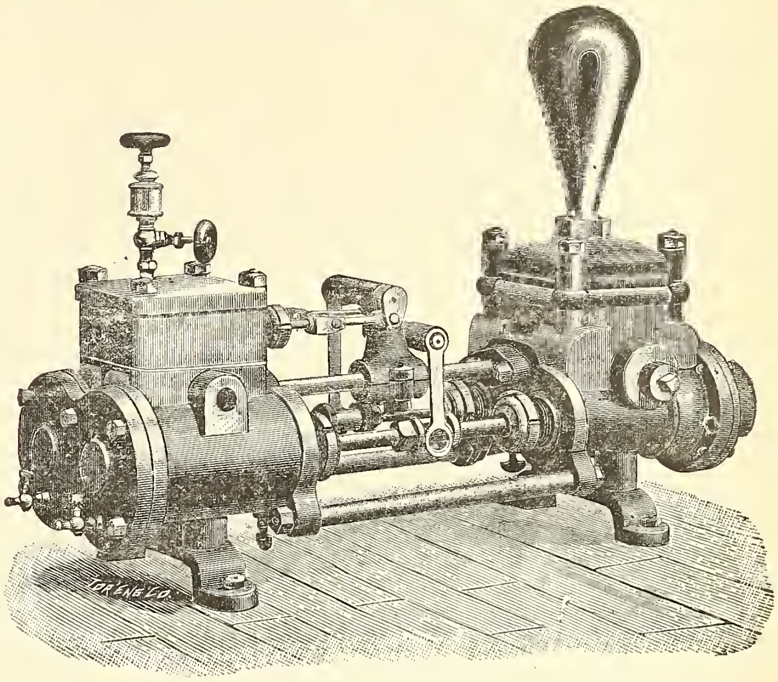

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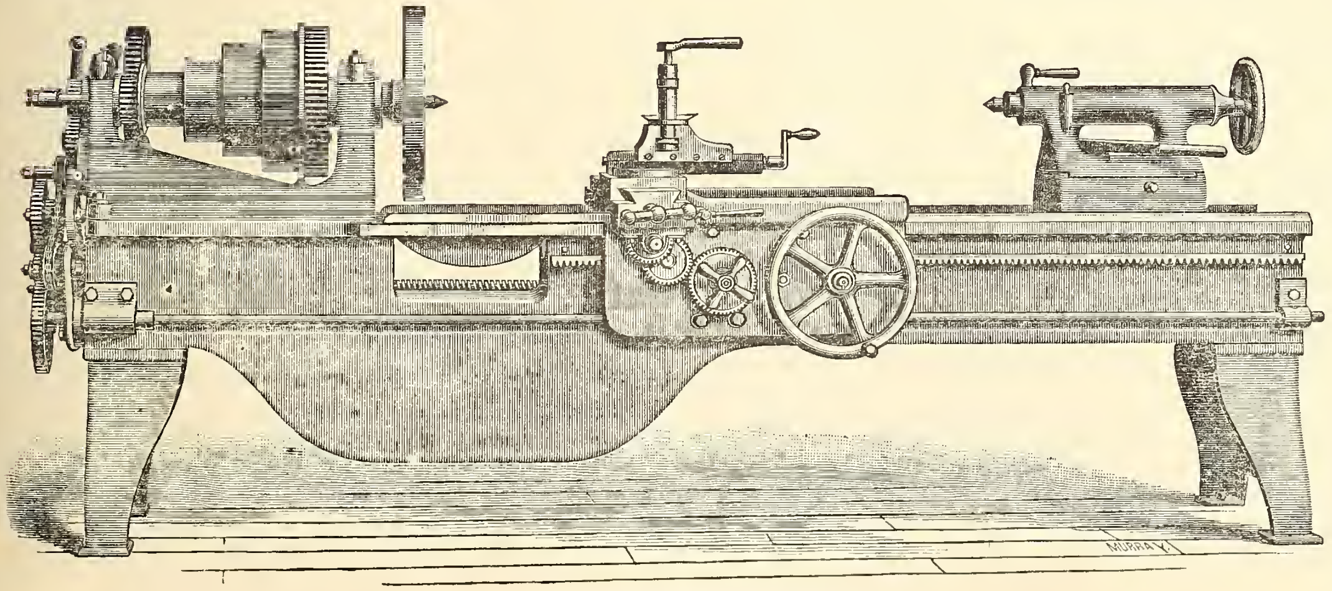

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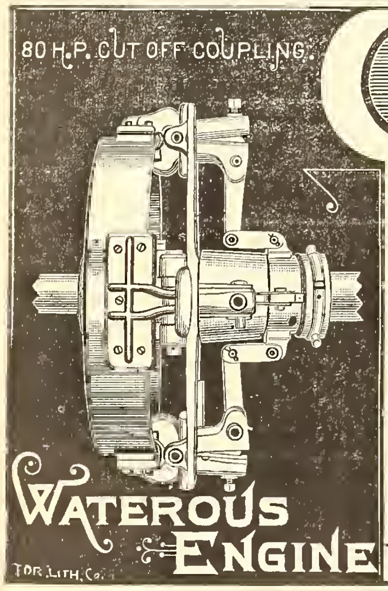
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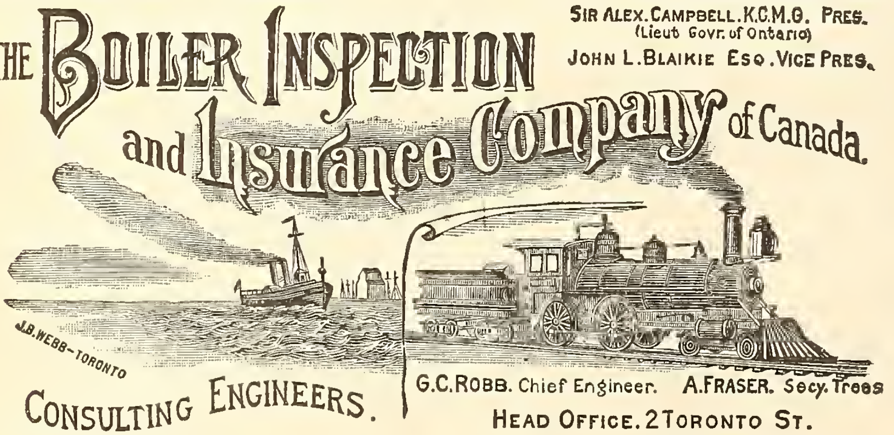

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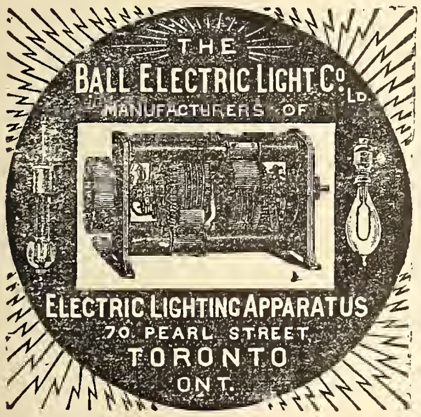

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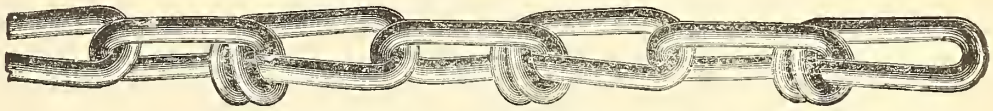

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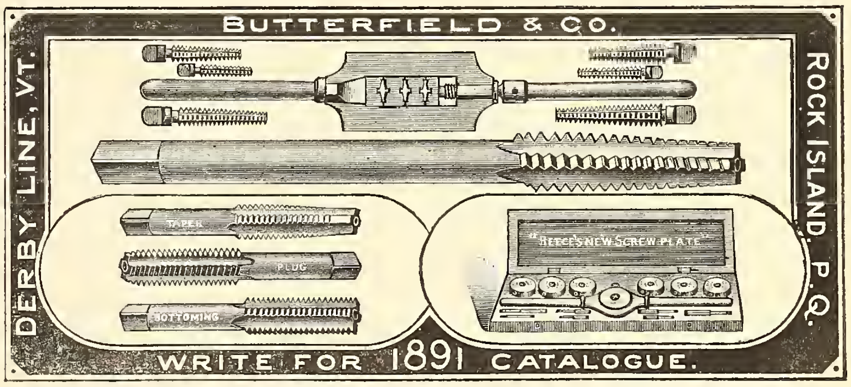
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Licenses are issued to owners of quartz crushing mills who are required to pay Royalty on all the Gold they extract at the rate of two per cent. on smelted Gold valued at $19 an ounce, and in smelted gold valued at $18.00 an ounce.

Applications for Licenses or Leases are receivable at the office of the Commissioner of public Works and Mines each week day from 10 a.m. to 4 p.m., except Saturday, when the hours are from 10 to 1. Licenses are issued in the order of application according to priority. If a person discovers Gold in any part of the Province, he may stake out the boundaries of the areas he desires to obtain, and this gives him one week and twenty-four hours for every 15 miles from Halifax in which to make application at the Department for his ground.

MINES OTHER THAN GOLD AND SILVER.

Licenses to search for twelve months are issued, at a cost of twenty dollars, for minerals other than Gold and Silver, out of which one square mile can be selected for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

All rentals are refunded if afterwards the areas are worked and pay royalties. All titles, transfers, etc., of minerals are registered by the Mines Department free of charge, and provision is made for lessees and licensees whereby they can acquire promptly either by arrangement with the owner or by arbitration all land required for their mining works.

The Government as a security for the payment of royalties, makes the royalties first lien on the plant and fixtures of the mine.

The unusually generous conditions under which the Government of Nova Scotia grants its minerals have introduced many outside capitalists, who have always stated that the Mining laws of the Province were the best they had had experience of.

The royalties on the remaining minerals are : Copper, four cents on every unit ; Lead, two cents upon every unit ; Iron, five cents on every ton ; Tin and Precious Stones ; five per cent. ; Coal, 7½ cents on every ton sold.

The Gold district of the Province extends along its entire Atlantic coast, and varies in width from 10 to 40 miles, and embraces an area of over three thousand miles, and is traversed by good roads and accessible at all points by water. Coal is known in the Counties of Cumberland, Colchester, Pictou and Antigonish, and at numerous points in the Island of Cape Breton. The ores of Iron, Copper, etc., are met at numerous points, and are being rapidly secured by miners and investors.

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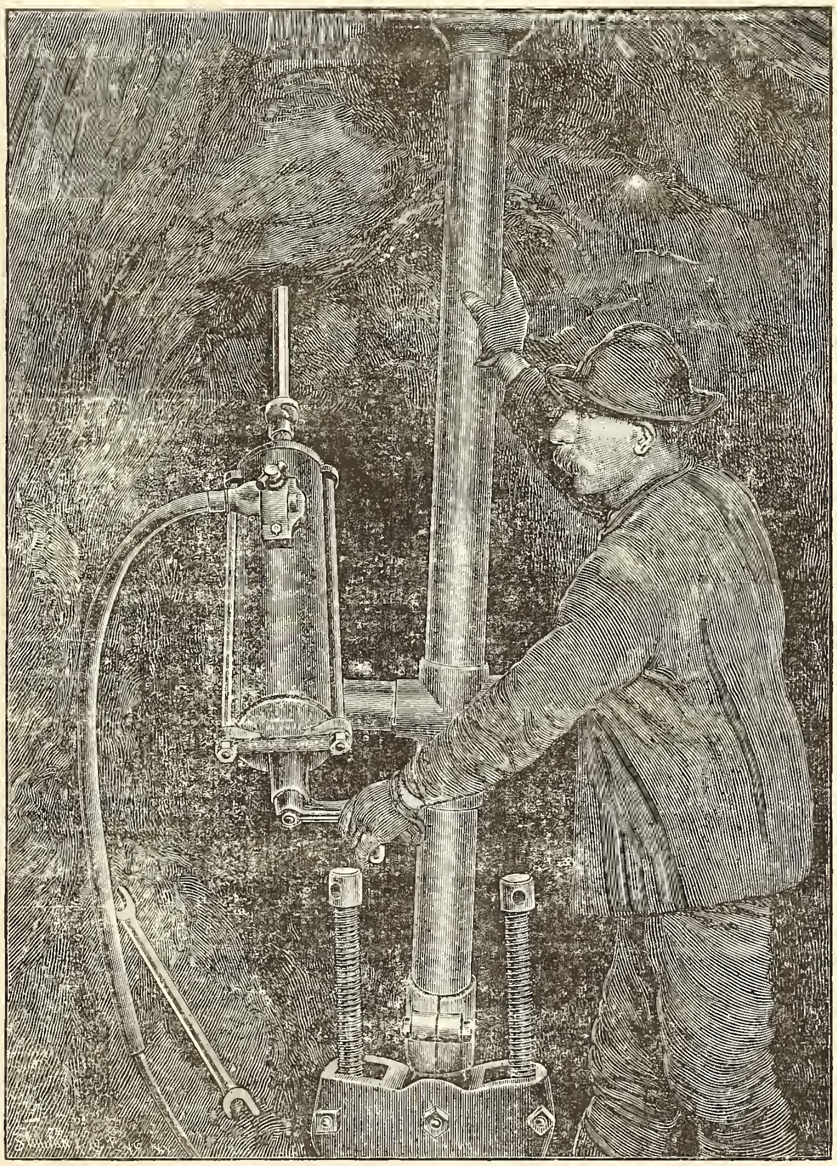

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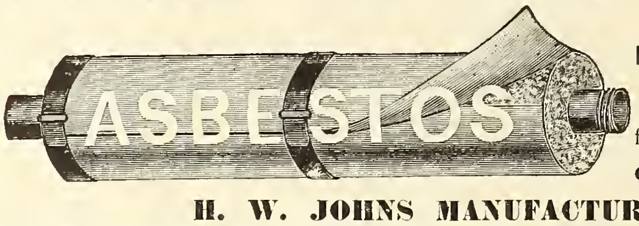

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Ontario Mining Laws.

The following is a summary of the chief provisions of the amendments to the Mining Laws of Ontario, passed during the Session of 1891:

1. In Algoma, Thunder Bay, Rainy River and that part of Nipissing north of Lake Nipissing and the French and Mattawa Rivers, the price per acre of mining lands sold after the 4th day of May, 1891, is $4.50 in a surveyed township, and $4 in an unsurveyed territory, if within 12 miles of a railway, and if beyond that limit $3.50 in surveyed and $3 in unsurveyed territory. Elsewhere the price is $3 in a surveyed township any part of which lies within 12 miles of a railway, and $2 if at a greater distance.

2. Instead of by grant in fee simple, mining land may be obtained under a ten years' lease at a per acre rental, unless otherwise fixed by regulation, of $1 for the first year and 25 cents yearly thereafter if north of Lake Nipissing and the French and Mattawa Rivers, or of 60 cents for the first year and 15 cents yearly thereafter, if situated elsewhere, with right of renewal at the expiration for an additional ten years at the same rentals, and with a right of renewal thereafter every twenty years, subject to payment of the yearly rent charge in advance and to such conditions as may be provided by regulation. But the lessee may at any time purchase the land so held, in which case the first year's rent shall be treated as part of the purchase money.

3. The owner or lessee of mining land sold or leased by the Crown after the 4th day of May, 1891, is required during the first seven years to expend in actual mining operations $4 per acre if the location exceeds 160 acres, and $5 per acre if it is 160 acres or less.

4. After the 4th day of May, 1891, all ores or minerals of silver, nickel, or nickel and copper, taken from lands sold or leased by the Crown, are subject to a royalty of 3 per cent., and all other ores or minerals to such royalties as shall from time to time be fixed by Order-in-Council, not exceeding in the case of iron 2 per cent., and as to any other ores or minerals not exceeding 3 per cent.; and such royalties shall be calculated upon the value of the ores at the pit's mouth. But royalties shall not be imposed or collected upon any ores until after seven years from date of the patent or lease, except as to mines known to be rich in nickel, and as to these not until after four years.

5. Hereafter in all lands sold under the Public Lands Act, or for agricultural purposes, all minerals and mining rights are reserved to the Crown, unless otherwise provided in the patent or grant.

6. In the case of mining lands for which bona fide application was made in writing to the Department prior to the 24th April, 1891, grants may be made where the application is received within three months from the 4th day of May, 1891, and otherwise at the price and upon the conditions heretofore applicable in accordance with the terms of section 1, sub-section 5, of the Act of 1891.

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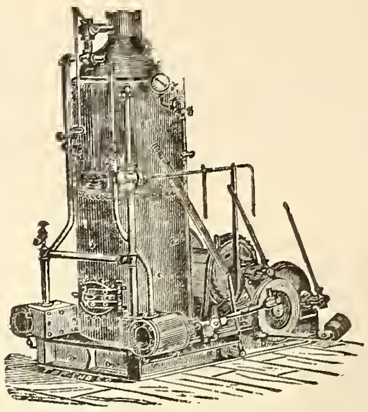

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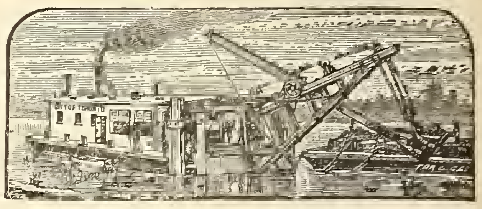

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Vol. X. JULY, 1891. No. 7.

To Our Readers and Contributors.

Owing to family bereavement our Mr. Bell has been suddenly called to the Old Country; during his absence all correspondence should be addressed to the publishers. Mr. Bell hopes to be back again by the 15th of September.

Modern Explosives.

During the past quarter of a century science pure and applied has come to the aid of almost every industrial occupation. The principles laid down by the mathematician and scientist in the cabinet have been applied in the workshop by the mechanic and chemist until the fact has become clearly known that no rule of thumb work can compete with that produced in accord with the economics of proved laws and their proper application. The cry of the miner has always been for more light. Right royal would be his road to fortune, could he tell from the inspection of an outcrop where lay the coveted pay streak, or how much per fathom the lode would yield when his shaft was deep in the ground—what would he care for faults, heaves, and cross courses, if he knew their extent and effect? However, if science has not yet been able to grant him these boons, she has placed at his disposal the modern metallurgist and assayist, electricity, and last, but not least, the high explosive, without whose aid many mines would be workable only at a loss, and many feats, such as the removal of Hell Gate and Flood Rocks, would be impossible; before dynamite and the patent drill yield rocks which were unassailable by powder and hand drilling.

Experience has so modified this benefactor, which first appeared as the enormously powerful but dangerous nitroglycerine that now it aids the miner in blasting the soft coal as well in rending the hardest stones.

Nitroglycerine at present finds its principal use in torpedoing gas or oil wells, but is familiar to the mining world under the disguise of dynamite, which contains about 75 per cent. of this explosive, associated with a material, such as wood pulp, capable of absorbing it, and thereby rendering it comparatively safe to handle if a little less powerful. This forms the earliest compound of nitroglycerine, its inclusion with an inert or non-explosive body. Much attention has been paid for a number of years to the problem of finding the best substance, in itself more or less explosive, which would, when added to nitroglycerine, render the resulting compound almost, if not quite as powerful, but much safer to handle.

Some years ago Mr. Alfred Nobel observed that the lower orders of nitrocellulose were soluble, or rather gelatinisable in nitroglycerine; experiments led to the production of blasting gelatine, gelatine dynamite, gelignite, etc. Blasting gelatine is an extremely powerful explosive, containing frequently 93 per cent. of nitroglycerine, and 7 of nitrocellulose, in itself a substance possessing explosive properties.

By varying the substances incorporated with the nitroglycerine, and increasing their proportions, the resulting explosive can be produced of almost any required degree of strength. It has been found on experiment that when a certain point is reached in the dilution of nitroglycerine by inert substances the results obtained on explosion are not always satisfactory or uniform. As remarked by Major Majendie, Chief Inspector of Explosives in England, dynamite becomes more inert when frozen, and blasting gelatine becomes more sensitive to explosion by percussion, while gelatine dynamite occupies about an intermediate position. One of the great advantages possessed by blasting gelatine over ordinary dynamite is that of not parting with its nitroglycerine when exposed to water. At present it appears probable that this compound, viewed from the standpoint of its more correct theoretical composition and more stable physical character, will gradually supplant the Kieselguhr dynamite, as that in its day supplanted the crude nitroglycerine.

Much need not be said here about gun-cotton, which excellent explosive has been adopted rather by the military than by the civil engineer. It is formed by the action of strong pure nitric acid on cotton, while collodion cotton is made from the action of dilute nitric acid upon the same substance at a high temperature.

Among the best known of the dynamite compounds the following may be mentioned: Lithofracteur contains nitroglycerine, 55 per cent.; kieselguhr, 21 per cent; charcoal, 6 per cent.; barum nitrate and sulphur respectively, 15 and 3 per cent. Ammonia powder is an excellent explosive, containing 80 parts of ammonium nitrate, 6 of sulphur, and 14 of nitroglycerine, the principal drawback being the ammonium nitrate which is hygroscopic. The explosives known as giant powders have nitrate of soda or potash as the principal admixture. Forcite is made up principally of blasting gelatine, with nitrate of soda, with sulphur or tar. It has been used extensively in the United States, and is described as safe to handle and very powerful. Hercules powder has carbonate of magnesia as the principal absorbent, and its fumes are said to be comparatively innocuous.

In 1871 a class of explosives possessing many valuable properties was brought to public notice by Dr. Sprengel. The essential principle of these compounds is the conjunction of two bodies, non-explosive when separate, one an inexplosive oxidising body, such as nitric acid, the other an inexplosive combustible agent, such as a solid or liquid hydrocarbon or its nitro-product.

As an example may be cited: One chemical equivalent of nitro-benzine to five equivalents of nitric acid, etc. These bodies, comparatively speaking, detonate by means of a fulminate with low temperatures, and of late years much attention has been devoted to their study in the hope that a substitute may be found to replace gunpowder in gassy or dusty mines. The best known of these compounds is Roburite, which has been used in the Nova Scotia coal mines to some extent. It is composed of chloro dinitro benzol, with nine times its weight of ammonium nitrate. The inventor, Dr. Roth, claims that its explosion evolves gases which so rapidly absorb the heat that the detonation becomes practically flameless. Bellite and Securite are other forms of this class. Rack-a-Rock, an explosive well known in the United States, consists of compressed cartridges of chlorate of potash impregnated before use with dead oils, or nitro-benzole, etc. The cartridges of potash chlorate are made up in cotton cartridges ready for immersion in the liquid. It will be remembered that a few years ago this explosive was successfully used in removing a large reef in New York harbor. The celebrated explosive Melinite, whose inventor, M. Turpin, is well known, has been largely used by the French government for military purposes. By agglomerating picric acid with an aqueous solution of gum arabic, etc., and by casting it when liquid into blocks, it will explode in a closed chamber such as a shell, etc., while it will resist a heavy detonator in the open air.

Experiments made in England with a mixture of equivalent proportions of ammonium picrate and saltpetre are said to claim for it explosive power equal to that of gun cotton and dynamite, readiness of preparation, and non-liability to explosion by percussion.

The report of the French government commission on explosives, shows that much attention was paid by it to the behaviour of dynamite and gun cotton mixed with substances hydrated but stable, such as ammonia alum, sal ammonica and nitrate of ammonia. As a result it appears that by mixing an explosive with substances which are non-explosive in themselves, or less explosive than the explosive itself, it is possible to diminish their power, and thus to make dual explosives which, while producing sufficient mechanical effects, do not cause, at least in the majority of cases, the ignition of fire damp. Dynamite, for instance, alone, when ignited produces heat enough to fire gas, but when mixed with about 80 parts of ammonium nitrate it is robbed of nearly all its danger, and the reduction of strength produced by the mixture still leaves it capable of blasting coal and the softer rocks. So much has now been done, and so many important principles have been authenticated by the European government commissions, that it is reasonable to anticipate in a few years the introduction of a safe, cheap explosive, readily detonated and flameless, and capable of use in all ordinary mining operations, especially coal blasting.

EN PASSANT.

In another place our Quebec readers will find a *verbatim* report of the interview with the Minister of Justice, in respect of the petition anent the Quebec Mining Law.

We are pleased to state that next month we hope to give our readers an interesting sketch of the "Early History and Progress of Coal Mining in Nova Scotia," from the pen of Mr. John Rutherford, the first Inspector of Mines for the Province. Mr. Rutherford's intimate acquaintance with the coal trade makes him probably the best authority on the subject at the present time, and his article will undoubtedly be of unusual interest, not only to Nova Scotians, but to coal miners elsewhere.

The Department of Public Works has given notice to miners and others on the Lievres River, above Little Rapids, that navigation will be closed at that point on and after August 10th, in order to finish the dam now being built. The work will be conducted as far as possible without interfering with shipments, and when such becomes necessary, it will only require about a month to complete the undertaking, so that navigation should be open again about September 10th. In the meantime shippers will forward all the phosphate they can before the closing, and the temporary inconvenience will be far outweighed by the benefits to be derived in the future.

A serious case of alleged fraudulent valuation of mica shipped to the States has come to light in the past few days. A Mr. Ames, special agent of the U. S. Treasury Department for the districts of Vermont and Champlain, recently learned that a certain firm near this city, engaged extensively in the shipping of cut mica consigned to a Boston firm, who in turn forwarded part of it to Schenectady, was defrauding the Customs. He therefore had a loaded car, which had been rebilled at Boston, examined at Richford, Vt., when he found his suspicions verified, as the mica had been billed at about half of its real value. The car was seized at once, and the Canadian Customs Department in Montreal notified. It is believed that the United States Government has been defrauded of about $10,000. It is said that other seizures will shortly be made of shipments made by other firms, in order to find the length to which this system has gone.

The bill dealing with the mining of phosphate in navigable rivers in Florida, referred to some time ago in these columns, has been passed by the Legislature of that State, and has gone into force. It constitutes the Governor, Comptroller and Attorney-General a Board of Phosphate Commissioners to manage the phosphate interests of the State. Royalties are imposed as follows: On rock analyzing less than 55 per cent. phosphate of lime, 50 cents per ton; between 55 and 60 per cent., 75 cents; over 60 per cent., $1, accounts and payments to be rendered quarterly to the State Treasurer. Furthermore, the Board may grant the exclusive right to mine rock from the beds of navigable streams, within certain limits, not to exceed ten miles by course of stream, for a period not to exceed five years, preference being given to those who had begun operations in good faith before the passage of the Act. This law will doubtless give rise to much litigation between the State and many companies, which claim vested rights in the river phosphate deposits. The trouble in South Carolina between the State and the Coosaw Mining Company is still unsettled, and the river industry there is practically at a standstill, so that the output of phosphate from these two States is not likely to amount to large proportions this year.

Mr. T. Shaw of gas-tester fame again favors us with a letter on that thread-bare subject, which in accordance with his request we reproduce. The matter was thoroughly thrashed out in our last issue, and we really do not see the good of continuing a discussion that has degenerated from the main issue to fighting over the meaning of a chance phrase. As Mr. Shaw is so well versed in bygone persons and events, we might remind him of a much more recent character, that celebrated lawyer "who could distinguish and divide a hair 'twixt south and south-west side," mentioned by Samuel Butler—a comparison perhaps more apt than that of the Emperor Basilius and his preserver. To carry this study of ancient personages a little further, we would commend to Mr. Shaw's consideration the study of the sixth proposition put forth by one Euclid—which line of argument he seems to have tried to follow—when he will at once perceive that the *reductio ad absurdum* is to be practiced on the opponent's arguments and not on one's own—a fact he hardly seems to be aware of. Apart from this, we must deprecate any further "splitting of straws," which cannot but engender more ill-feeling; if either party has anything further to say on the main question we shall be happy to publish it, but we think that the wisest course is to let the matter drop. Each has let the other know the opinion he entertains of him, and if they argue until the day of judgment they can do no more; neither will either be convinced or put in the wrong.

The intended autumnal meeting of the American Association of Charcoal Iron Manufacturers at Niagara and Toronto early in September, will afford an opportunity for discussing estimates and considering the prospects for the erection of a charcoal furnace in the eastern section of Ontario. The Association has been invited by the Toronto City Council to visit that city on their usual excursion, and thence proceed to the Haliburton district and view the magnetic ore mines there. The members will extend their excursion eastward to Kingston and thence to the Chateauguay iron mines and forges in the Adirondacks. At Kingston they will be entertained by the Board of Trade. The Association aims at making these annual reunions profitable rather than merely pleasurable, by interchanging experiences and knowledge. Their labors have resulted in the improvement of charcoal furnace construction and management to a remarkable degree. This is no doubt mainly due to the zeal of Mr. John Birkinbine, Secretary of the Association and President of the American Institute of Mining Engineers. The visit of the Association can scarcely fail to give birth to the construction of one charcoal iron plant, and although Mr. Birkinbine has put himself on record against the erection of "blast furnaces as town attractions," no doubt any objections on that score will be eliminated from the discussions at Kingston and Toronto, and the superiority of town sites to those in the vicinity of wood and ore will be proved in the estimated expenses of management.

A discovery that may prove of vast importance to the nickel interests of Sudbury, is claimed to have been made, whereby iron and nickel can be produced by precipitation. The originators of the process appear to have been Messrs. Mond, Lang and Quincke, who have obtained nickel of a high quality by the action of carbonic acid upon very poor ores. A French scientist, Mr. Berthelot, has further advanced the discovery, and has effected a similar combination with iron. According to him, the process is not limited in its scope to any metal, and it is consequently of great value in the production of such rare metals as nickel. So far the success of the experiments has been complete, and from all appearances there is no reason to doubt that the results will be as satisfacrory when applied upon a commercial scale. The value of such a process to our nickel mines would be very great, and further developments will be awaited with interest.

The depression in the phosphate market still continues, the tendency of all phosphates being decidedly lower. Latest advices from England state that Florida 75 to 80 per cent., is being "hawked about" at 11d.; last quotations give Canadian 80 per cent. at 1s. It is expected, however, that the Fall trade will bring about an improvement in the market.

The statistics of the British Iron Trade Association for 1890, compiled by the Secretary, Mr. James, show that the iron trade holds its own very fairly, notwithstanding the increased output of steel, and in some countries, notably Russia and Austria, is making greater progress. The total production of pig iron in Great Britain last year was 7,875,130 tons, or 1,327,573 tons less than the United States, and the consumption, 7,294,684 tons. The make of Bessemer steel ingots last year was 91,000 tons more than of puddled bars, the respective figures being 2,014,843 tons and 1,923,221 tons. The number of puddling furnaces in operation was 3,015, or 331 fewer than in the preceding year. The average production per furnace was 637 tons as compared with 673 tons in 1889.

Our August issue will be published on the 15th, a little earlier than usual. Will contributors kindly send in their matter before that date?

Our Portrait Gallery.

[A series of portraits and biographical sketches of Canadian mining engineers, mine managers, inspectors, geologists, explorers, etc.]

No. 13.

G. M. Dawson, LL.D., F.R.S., F.G.S., etc., Assistant Director of the Geological Survey of Canada.

Although yet but a comparatively young man, Dr. G. M. Dawson has earned an enviable reputation as a geologist and scientist, and in recognition of this he has lately been appointed to represent England, jointly with Sir George Baden-Powell on the Behring Sea Commission.

He was born in Pictou, Nova Scotia, on August 1st, 1849, and is the son of Sir William Dawson, Principal of McGill University, Montreal, whose researches in geology are well known. Dr. Dawson's technical education began at McGill College and was completed at the Royal School of Mines, at each of which he obtained his degree. At the latter he held the Duke of Cornwall's scholarship, given by the Prince of Wales; he also took the Edward Forbes medal in palæontology, and the Murchison medal in geology.

The first work of any importance in which he was engaged was in 1873, when in the capacity of geologist and naturalist to Her Majesty's North American Boundary Commission he investigated the country in the vicinity of the boundary line between Canada and the United States from the Lake of the Woods to the Rocky Mountains. The information thus gathered was, at the end of the Commission's work in 1875, published in the form of a report entitled "Geology and Resources of the Forty-ninth Parallel," and this amongst other things gave the first detailed account of the Souris coal fields, though some of the sections along the Souris bed had previously been visited by Dr., afterwards Sir James, Hector. The economic results of this were important as setting at rest the question of a fuel supply for the prairie country. In July of the same year began his connection with the Geological Survey, with which he has ever since been identified. His first important trip in his new appointment was to British Columbia, where, until 1879, he was engaged in the exploration and geological survey of the Province. This has been the scene of his labors ever since, with very little exception, and the knowledge obtained of the geological structure, and the geological mapping of British Columbia, so far as it has gone, is almost entirely due to the energetic work of Dr. Dawson. From that time until 1882, he continued his labors in that Province and in the North-West Territories. In the latter year he went to Europe, where he travelled extensively, visiting mines, metallurgical works, museums, etc. His most arduous journey after his return was with the Yukon expedition, of which he was selected by the late Hon. Thos. White to take charge; a very complete report of which has recently been published by the Geological Survey. The route he chose for himself, although of a most difficult nature, was taken as that most likely to afford the most information regarding the geology of the vast and virtually unknown tract of country he was about to explore. His journey was 1,300 miles in length, from the mouth of the Stikeen River, by way of the Dean, Upper Liard, Pelly and Lewis Rivers back to the coast. Nearly the whole distance was traversed by following the rivers; some of these had in former years been used by the Hudson's Bay Company, but they had long been abandoned as a trade route, and were at the time of his expedition almost unknown geographically. The difficulties encountered were very great,—boats had to be built at several points, and one portage of fifty miles was made through the woods in crossing from the drainage-basin of the Liard to that of the Yukon,—but all were surmounted and the expedition successfully accomplished its work.

Yours very truly
George M. Dawson

Details of Dr. Dawson's travels throughout British Columbia and the North West will be found in the Reports of the Geological Survey. He is the author of fifteen separate reports, of which the following may be referred to as of most importance: On the Queen Charlotte Islands, including as an appendix a monograph on the Haida Indians (1878). On an exploration from Port Simpson on the Pacific Coast to Edmonton on the Saskatchewan (1879). On the Region in the vicinity of the Bow and Belly Rivers (1882-4). On the Physical and Geological features of part of the Rocky Mountains (1885). Notes to accompany a geological map of the Northern portion of the Dominion of Canada (1886). Author (with Dr. Selwyn) of Descriptive Sketch of the Physical Geography and Geology of Canada (1884). Author (with Dr. W. F. Tolmie) of Comparative Vocabularies of the Indian Tribes of British Columbia, with an Ethnological Map (1884). It is unnecessary to particularize the numerous and valuable original scientific papers on the geological, geographical and ethnological observations made in the course of his explorations and contributed to various scientific journals; their value is well known and fully appreciated.

Dr. Dawson was last year granted the honorary degree of LL.D., by Queen's University, Kingston, and the Bigsby medal of the Geological Society (London) has lately been awarded him in recognition of his services to geology, but the chief distinction accorded him was his recent election as a Fellow of the Royal Society of England. If his success so far be taken as an earnest of his achievements in the future, it may well be expected that he will rise to a position yet more distinguished than his father, a prediction that implies a high place in the ranks of science.

◆

A committee appointed some time ago by the Belgian government to draw up regulations for the control of explosives, has just presented its report. There are at present eight gunpowder factories and five works producing dynamite in the country, the output of the former being 2,500 tons, and of the latter 250 tons per annum. Under existing legislation anyone may purchase dangerous explosives, and even the miners buy their own dynamite for use in the coal mines. The government has adopted the report and will put into effect the provisions suggested. Special permission will have to be obtained in the future for the manufacture and sale of dynamite, and the licenses now issued will be of no value; the retailing of dynamite will be prohibited, and mine owners and managers will be obliged to supply the miners with dynamite as required; restrictions will also be placed on the sale of gunpowder. In order to keep a record of purchases, each dealer in explosives will have to keep a register containing the names of buyers. The enforcement of these regulations will, it is hoped, greatly reduce the number of accidents due to careless handling and indiscriminate sale.

CORRESPONDENCE.

Editor Canadian Mining and Mechanical Review:

SIR,—In your June number you insert considerable correspondence on the Shaw gas tester which is fair to all parties. Your editorial observations, however, are not warranted by any single feature in the correspondence. Mr. Poole's letter, page 149, centre column, makes mention of a proposition to remove a bulk of air and gas through a ¼ inch tube, when in reality, the full area of gangway is required for its removal. This is too ludicrous to make other answer to, further than refer him to his own problem, which, since it originated in his own brain and is one of those particular conundrums that others give up, it will be in order for him to explain.

In reference to the pent up gases, it is rather late in the day for Mr. Poole to give instructions in this well known feature, understood by every person who works in or about a mine.

In reference to the report on the Springhill disaster, I had nothing whatever to do with the report, and was not aware of its existence until I read it in the American papers which copied from the Canadian papers. The facts as I have learned from private sources, are, that the jury rendered a verdict, but before retiring made a written recommendation, which they had a perfect right to do, if, in their judgment, these horrible accidents from explosive gases could be in any wise prevented or lessened in the future.

Your readers may be curious enough to inquire what possible motive can actuate Mr. Poole to ventilate his grievances in public and to assail his personal friend, whose only offence consists, first, in advocating in strong language safety measures to protect life in mines; and secondly, in seeing danger where Mr. Poole rests in full confidence of safety, which makes such a wide difference of opinion between these gentlemen, that, time and circumstances alone can settle this question to Mr. Poole's satisfaction. Unfortunately Mr. Poole is grossly offended at his friend's impulsiveness, and he now gives a sort of public notice to friends and others, that if, in the future, they ever see him in any real or imagined danger, they must approach him in the most delicate and ceremonious manner, or suffer his eternal condemnation with possible public ventilation. In short, I believe that the friend who attempts anything of this kind with Mr. Poole may feel in as bad a plight as the gentleman who thought that his Emperor Basilius, was in danger, when his horse ran away dragging the unfortunate Emperor by the stirrup, which stirrup the citizen promptly cut with his sword, and for which unceremonious act the ungrateful Emperor promptly ordered his execution.

All I have claimed to have done in connection with this matter is to have solved one of the most important problems on the question of "dangerous gases," in providing an instrument that weighs and measures explosive gases as readily as a druggist's scale weighs solids, thus placing this important question of "dangerous gases in mines," beyond the pale of guesswork, and bringing the subject within the realm of exact science, in a manner so simple that it can be operated by the unskilled, to protect life and property in all the mining districts of the world.

Yours truly,

THOMAS SHAW, M.E.

P.S.—Your editorial observations and Mr. Poole's remarks necessitated a reply from me, which, in justice to all parties I trust you will insert in the columns of your next issue.

T. S.

PHILADELPHIA, July 7th, 1891.

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Combustion of Coal.—As one practical result of his investigations into the combustion of coal, M. Scheurer-Kestner found that, while from eleven to thirteen per cent. of the heat is carried up the chimney, the heat absorbed and radiated by the brick work setting of steam boilers attains from 17 to 27 per cent. of the total amount produced. Starting from this, MM. Mattieu Freres, of Mulhouse, have devised their "Gorgones Calorigenes" cast iron pipes enclosed in the masonry, and put into communication with a fan for utilizing the heated air. They claim to have arrived at such a regime for the air current as shall abstract the same amount of heat as that given off by the masonry, the latter giving off no less if the apparatus be not employed.

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A Remarkable Run of Iron.—The Mancelona (Michigan) *Herald* says: Stack No. 2, blast No. 1, of the Antrim Iron Furnace, completed the third year of its present blast April 15. Number of days in blast, 1050; and the total product during that time amounted to 66,347 tons of pig iron—a daily average of 63½ tons. A trifle over a year and a half of this run—or, to be exact, 582 days of it—the stack was blown with a small Weimer engine, with a product of 32,326 tons, a daily average of 55⅔ tons. The balance of the run—468 days—was made with a large engine of the same make, during which time the product amounted to 34,021 tons, a daily average of 72⅔ tons. To make this amount of iron, 115,410 tons of ore were used, and 146,000 cords of wood consumed. Had the stack been blown during the entire period with the large engine, the total product would, of course, have been much greater, but the record is a remarkable one, nevertheless, and it is believed that no charcoal stack in the United States has ever made so long a run or so large an amount of iron with a single lining.

The Quebec Mining Law.—An Influential Deputation from the General Mining Association Waits on the Minister of Justice and Asks for its Disallowance.

The Petition prepared by the General Mining Association of the Province of Quebec, having been presented to the Privy Council, and a hearing being granted by the Hon. Sir John Thompson, Minister of Justice, the following deputation attended at Ottawa on the morning of Friday, the 17th inst.: A. Desjardins, M.P., Montreal; W. B. Ives, Q.C., M.P., Sherbrooke; Hon. George Irvine, Q.C., Quebec, President of the Association; C. Magee, Managing Director Bristol Iron Co., Ottawa; J. Lainson-Wills, Manager General Phosphate Corporation; Capt. Robt. C. Adams, Managing Director Anglo-Canadian Phosphate Co., Montreal; Hector McRae, Ottawa, and B. T. A. Bell, Secretary General Mining Association. The members were received by Mr. Robt. Sedgewick, Q.C., Deputy of the Minister of Justice, at half past ten o'clock.

HON. GEO. IRVINE, Q.C., said: There are three grounds upon which we seek to have this Act disallowed. 1st. We claim that it is an unreasonable law because it deprives people of their vested rights in property for which they hold a title from the Crown itself. 2nd. That it is contrary to the general interests of the Dominion and to the policy of the Dominion Government. I presume that that would be a principle governing the disallowance of the Act, because it would produce chaos if the provinces were allowed to adopt Acts which nullify the policy of the Dominion Parliament and Government. 3rd. Because it tends to so impede, and in many cases to put a stop to the exercise of an industry which is of great importance to the whole Dominion. Now with reference to the claim that it takes away private property, that is most easy to understand and the simplest. In 1880, an Act was passed regulating Crown Lands generally, and having a particular reference to mining. Prior to the passing of that Act, it had been universally admitted and judicially decided, and the whole course of the jurisprudence of the country, as well as the management of the Crown Lands Department, and the regulations made by them, went to establish that where lands were granted without a reserve of minerals, all the baser metals—except gold and silver—became the property of the lessee. There is no doubt about that. Mr. Irvine here cited several important legal decisions in support of his contention.

MR. SEDGEWICK—If a seignior owns land in the Province of Quebec he may convey his interest and reserve the mines.

HON. MR. IRVINE—No; they cannot do that.

MR. SEDGEWICK—Well, they can do it here and in all the other provinces.

HON. MR. IRVINE—You have no seignorial tenants in the other provinces.

MR. SEDGEWICK—But if you own a piece of property in the Province of Quebec, can you not reserve for yourself—an easement we would call it—for the purpose of having something off it?

HON. MR. IRVINE—The holding of the seigniory under the Feudal Rights is different from the holding of lands under the Crown. The former were made with a view to settling the country, copying the old style which still exists in France, and they were bound, whenever an application was made by a settler to make a grant to him, subject to an annual rent. One of the questions put by the Crown to the Court in one of the cases I have referred to was, whether, if a seignior reserves the baser metals in making a grant, would that reserve be legal. The Court held that it would not; that the property of the baser metals would go to the tenant censataire.

MR. SEDGEWICK—That was in consequence of the original grant under the Feudal law to the seignior.

HON. MR. IRVINE—I refer to that for the purpose of showing that a long time back the jurisprudence of the country held that the property in the baser metals, where they were not reserved, went to the owner of the soil.

MR. SEDGEWICK—I suppose you are giving that particularly because the Act alleges that all the mines in the province belong to the Crown. Is there any authority with respect to that argument in the Act?

HON. MR. IRVINE—Not in the slightest. In the case of the Queen v. DeLery, the question was the ownership of gold. In the original grant to DeLery there was no reservation of the precious metal, and it was argued that gold was included in the grant to the seigniory and that it followed that it went to the censitaires when the land was conceded to them. Later on the DeLery family, who were the seigniors of that property, made application to the Crown for a grant of the gold, and letters-patent were made out and they have held possession of the gold deposits ever since, under that title.

MR. SEDGEWICK—Was this in Lower Canada?

HON. MR. IRVINE—Yes, in the district of Beauce. There is gold there, they are working at it now, and at one time there was a fairly large development. In that case (the DeLery) it was held that the ownership of the gold did not pass to the seignior, therefore it did not pass to the censitaire.

MR. SEDGEWICK—But the Court of Appeals held that that did not apply to the baser metals that belong to the land. I do not think there can be any doubt but that everything does pass, unless expressly reserved.

HON. MR. IRVINE—The Act of 1880, provided, "That all grants which were made subsequent to the passing of the Act shall not be necessary to make a reserve of minerals when they were held to be reserved, that being so stated." Well, that of course was perfectly legitimate legislation, because it did not affect any vested rights, and anybody taking a grant took it subject to that legislation. But there was an important provision in that Act, *i.e.*, that if a man took a grant from the Crown under ordinary circumstances, that is for agricultural purposes, in which, under the Act, the mines shall be reserved—if such a person afterwards discovered minerals on the lot, he would have the right to obtain title to them by paying the difference between the agricultural price and the mineral price.

MR. SEDGEWICK—Did the province fix the price?

HON. MR. IRVINE—It fixed the price of the mineral lands, but the agricultural price varies. So that you understand everyone who obtained a grant of land previously was owner of the minerals under the general principle, but that everyone who obtained land after 1880 were not owners; but they had the right to purchase at the price fixed by the province. They would have the right when they discovered minerals upon it, to purchase the land by paying the taxed price. This was done in a property in which I am interested. This old Act was not objectionable for it interfered with no vested rights which came into existence after 1880. You will see, therefore that there are several classes of persons to be considered. Those who hold land under old grants; the holders of land under old titles, in which titles the lands have not been reserved to the Crown——

MR. SEDGEWICK—I would like you to give me some evidence. You might, for instance, give evidence that you hold some lands under titles in which there is no reservation of that kind.

HON. MR. IRVINE—I can cite you a case of one of the best asbestos mines in the Townships, where the owners hold, and their predecessors held, their lands since 1802. The original grant was made in 1802, and descended by a regular chain of titles from the King family. They owned it for some twenty years before minerals were discovered, and they are now in the condition of persons holding land under a title direct from the Crown, in which the minerals were not reserved.

MR. MAGEE—I could cite another case where there is a very serious complication arising out of the operation of this new Act. Parties owning patented lands leased them to mining men at a certain rental per annum. These parties continued work for a number of years and the lands again pass into the third and fourth hands. I represent the Bristol Iron Co., and we are really the fourth purchasers—that is, we took an assignment of the original lease of the mining rights (a 99 year's lease), paying a rental. We erected machinery and plant and have considerably developed these mines, investing quite $150,000. We then got an opportunity of leasing, not only giving an assignment to all our rights in the mines, but of leasing our plant and machinery for a royalty of so much per ton, so that these last people have really to pay three rents, that is, if the new Act is held to be constitutional.

HON. MR. IRVINE.—That has reference to the tax.

MR MAGEE—They pay a tax to the owner of the soil, the royalty to the owner of the mining rights, machinery and plant, and then they have to pay three per cent. under this new Act, to the Government, on the merchantable value of the quantity raised, before they can export their ores.

HON. MR. IRVINE—I should say that, although there is no diffierence otherwise, there is an exception in the case of phosphate lands, principally as regards the date from which the law of 1880 takes effect. There has been a change made with regard to these lands in 1878, so that as regards phosphates, 1878 is the date referred to instead of 1880, as in the case of the other minerals. In the interpretation clauses of this Act the definition of public and private lands is described as follows:—

"The words 'public lands' mean and designate all Crown lands or Ordnance lands transferred to the Province, etc., which have not been alienated by the Crown."

"The words 'private lands' designate all lands conceded or otherwise alienated by the Crown, other than mining concessions or lands conceded by the Crown as such, or which shall hereafter be conceded."

So that when private lands are used, it does not in any way affect lands granted as mining lands. Now clause 1425 says:—

"As it is admitted that mines, whether upon public or private lands, belong to the Crown, and any person discovering a mine may purchase the same, by complying with the provisions of this law."

Now private lands mean all lands which are not conceded as mining lands, that is to say, an ordinary grant for agricultural purposes is called "private lands," and the Government now declare that all these lands belong to the Crown.

MR. SEDGEWICK—Of course, you have to give that a limited meaning. That may mean all mines upon public or private lands belong to the Crown where the Crown has not already parted with the title.

HON. MR. IRVINE—They define "private lands" to mean all lands which are not granted with mining privileges. Then this clause goes on following up this provision. "Upon private lands, however, the occupant of the surface has the first right to purchase such mine, upon the conditions imposed by law and the regulations.' Before coming to that, however, the next clause provides :—

"From the first day of May, 1891, a royalty shall be levied in favour of the Crown, upon every mine which is now, or may hereafter be sold, conceded or otherwise alienated. Such royalty shall, unless otherwise determined by letters-patent already granted, consist of a percentage of three per cent. of the merchantable value of the products of all mines and minerals."

Now the meaning of that is that on all minerals taken from the Province of Quebec, there is a royalty of three per cent. whether, the lands were sold as mining lands or otherwise.

MR. SEDGEWICK—Now, wherein do you say that this is unjust—any more unjust than a tax—say an income tax?

HON. MR. IRVINE—An income tax would not be a particular industry.

MR. SEDGEWICK—In what respect is it different from a license?

HON. MR. IRVINE—It is greatly different. You have to pay license fees besides this.

MR. SEDGEWICK—I mean a license to carry on a business or profession. It is a general tax upon a particular industry, it is true, but does it differ in any moral sense from any particular tax which a province may impose, for instance, they say an insurance company shall pay a certain tax?

HON. MR. IRVINE—The Privy Council decided that these commercial taxes were constitutional. Therefore, the question as to the legality of the law relating to one particular industry in face of that decision has been settled.

MR. SEDGEWICK—I agree with you that we ought to look askance at an Act which professes to interfere with vested rights—to take one's property without compensation and give it to the State.

HON. MR. IRVINE—I only mention this fact now—that they use the word "royalty," implying on the part of the person, the Crown or individual who levies that right by statute, or otherwise, ownership in the property from which royalty is paid.

MR. SEDGEWICK—It does not make any difference what they call it. You say the Act infringes upon private rights in some other way.

HON. MR. IRVINE—I say I have a right to assume that all rights upon private lands conceded previous to 1880 belong to the grantee, and that all granted since 1880 belong to the grantee, subjected to the payment of certain sums of money. I will show you how the carrying out of this Act infringes upon private rights. You will observe it says that the Crown may sell mines on private lands subject to certain regulations. Section 1455 says: "Every person firm or company may explore and prospect for the discovery of mines and minerals upon public lands not already occupied as mining concessions or otherwise."

And section 1461 says: "Any person may obtain from the Commissioner the sale of one or more mining concessions upon the following conditions :—

1. Upon private lands, after the owners thereof have been placed *in mora* to take a sale thereof, if they refuse to avail themselves of such rights; the whole in conformity with this law."

MR. SEDGEWICK—Do you not think a limited construction must be given to that, and apply it only to those lands which contain a reservation of minerals.

HON. MR. IRVINE—Take the lands since 1880, they have been by law reserved and subject to the right to purchase them.

MR. SEDGEWICK—Then may not that section only apply to those lands?

HON. MR. IRVINE—If that would be the construction the courts would give it; but I think it very doubtful. Now you see the effect of that legislation is that any person may go to the Crown and obtain a permit for exploration of private lands. He has the right to go on private lands and examine the lot, and he may take 50 acres of this lot, measure it out, go to the Commissioner of the Crown Lands and deposit the price which he considers this property is worth. There is a minimum price fixed by the Act but no maximum price. He must deposit at least $5 per acre. We will take a man who has held a mining property for years. He believes by law that it belongs to him. Another man may go and obtain a permit from the Crown, go on to his property and measure out 50 acres, he offers $100,000, which this man must take or lose his property. That is a most outrageous invasion of private rights. The next point I spoke of is whether this tax (assuming it to be a tax), is of such a nature as to be unreasonable and against the public policy of the Dominion. As regards some mines it may be said that it is not although a very heavy tax, but of course as its being reasonable or unreasonable, that is within the right of the legislature that has power to pass the law to say.

MR. SEDGEWICK—Is the 3 per cent. royalty on the gross value of the output at the pit's mouth?

HON. MR. IRVINE—Yes. If you get a large quantity of minerals and for one reason or another you cannot sell them, you have got to pay this 3 per cent. not only on the minerals themselves but on the cost of producing them.

MR. SEDGEWICK—Who determines the value?

HON. MR. IRVINE—They have inspectors who tax the value.

MR. SEDGEWICK—Have they principle upon which to fix the value?

HON. MR. IRVINE—No; there is no principle. There is no doubt that this tax weighs very heavily upon a large number of the mining industries of the country, and more particularly with regard to those industries where the marginal profit is very small, and the quantity produced very large and a great number of men employed. Of course the fact of a number of men employed is included in the small margin of profits. Supposing a man is working a mine and he with difficulty makes a very small profit. If you bring in a tax of 3 per cent. on the gross output of that mine you may walk off with all his profits and make the Government pay something out of his capital. Now, the effect of this will be to put a stop to a large number of mining industries in which the Dominion has a very important interest. It is in the interest of the whole country that these industrial enterprises should succeed, and if the Provincial Government kills that by putting on a tax, it appears to me that the Act is one which the Dominion Government ought to disallow.

MR. SEDGEWICK—If it was perfectly clear that the object of this Provincial Act was to kill a particular industry, the Government would perhaps have good grounds to do so. We could not disallow an act because it affects a particular industry unless clearly shown that the intention of the act was bad and was aimed at the policy of the Government as a whole. For instance, the Legislature of Quebec has taxed the banking business very seriously, so as to prejudicially affect the banking interests, but we could not disallow that act.

HON. MR. IRVINE—They put a heavy tax upon banks, but they did not put anything to seriously affect banking commerce.

MR. SEDGEWICK—They have compelled insurance companies to take out licenses in every town in which established. However, it seems to me that the imposition of a 3 per cent. tax would not be sufficient to justify the disallowance of the Act.

HON. MR. IRVINE—But suppose it were shown that in certain branches of the mining industry the effect of this would be to stop them altogether?

MR. SEDGEWICK—Well, I think that is a matter for the province to look after. While the Dominion Government has a general interest in the whole of the trade and industries of the country, I do not think it can interfere here.

HON. MR. IRVINE—At the last session of the Dominion Parliament all machinery imported for mining purposes was put on the free list—all not manufactured in Canada. Well now, that of course was of great assistance, but if the Province of Quebec comes in and takes off the benefit of that by levying a tax, they are certainly defeating the object which the Dominion tried to attain by taking off that import tax.

MR. SEDGEWICK—They may do the same thing by coming into the market and borrowing a lot of money. The point is where shall we draw the line.

HON. MR. IRVINE—I think that the Government are bound to disallow the Act for the first reason given—the interference with private rights.

After some further talk on the part of Messrs. Magee, Capt. Adams and Mr. McRae, the deputation thanked the Deputy for his courteous hearing and withdrew. It is understood that the Hon. Mr. Irvine will submit a written statement of his pleading in the matter.

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New Electrical Chlorination Process.

The first practical demonstration of the extraction of gold by means of chlorine, is, it is believed, due to the late Professor Plattner, upon whose discovery all subsequent improvements are based. The most noteworthy modifications and improvements are those of Calver, Jackson, Ott, Mears, Deeken, Patra, Rœsner, Hauck, Newbery, and others of less note. The introduction of electricity in the extraction of gold is of more recent date, and the leading names of those who first adopted this method are Pichenor, Ancel and Marie, and Cassel.

Mr. Th. Ranft, M.E., of Sydney, has just introduced an electric-chlorination process, says the *Australian Mining Standard*, in which he claims to have overcome the vital defects before experienced in electrical chlorination, viz., the getting rid of the sequent hydrogen and sodium as they are formed by the electric current when passing through the electrolyte. In all processes where the hydrogen cannot be kept separate from the chlorine gas, the two will combine and form hydrochloric acid which combination does not solve gold and is in every way most injurious to the process. The inventor does not claim or patent any new law, but an apparatus by means of which the laws observed are complied with. The apparatus consists of two cylinders, one within the other. The inner cylinder, made of a porous material, serves four functions, viz., 1st, as a filter; 2nd, as the negative pole or cathode; 3rd, it acts as a burrette to allow the precipitated gold to escape along with the caustic soda, and lastly, it allows the formed hydrogen gas to escape at the top. The outer cylinder, which is air tight (except at the places where it is required periodically to discharge) serves three purposes; firstly, it forms the positive pole or anode of the battery, next it acts as a chlorine gas generator and store, and lastly as the chlorinating vessel.

The process performed in the apparatus is described as follows: The ore to be treated (free of sulphur arsenic, lead, zinc, or bismuth) is mixed in certain proportions with common salt. It is then fed into the outer chamber, where the anode is, and the electric currents enter. Water is then added, which dissolves the salt in the ore, and this combined with the saline liquor forms the electrolyte. An electric current from a dynamo is then led into it by the anode, and passing through the solution into the inner chamber or cathode, is discharged back to the dynamo. The chemical action produced by the passage of the electricity is to decompose the electrolyte into its elements. Hydrogen and oxygen are the products of water, chlorine and sodium those of the salt. Hydrogen being a positive substance, deposits on the negative pole; oxygen, on the other hand, being negative, deposits on the positive pole. Chlorine and sodium deposit respectively on the positive and negative poles. In order to prevent the accumulation of oxygen and hydrogen, contrivances are provided, which continually wash the surfaces of the anodes to prevent polarisation, which would stop the whole process. With regard to chlorine, it has been established by Beguerel that chlorine in its nascent state is more active than afterwards, so that if in the ore under treatment any gold is present, it would now be most readily attacked by the chlorine and form itself into chloride of gold (salt of gold) which again is soluble in water.

The gold now being in solution is readily acted upon by the electric current. The molecules, as established by Grotthus, 1805, are under the same condition as any other molecules, which in their transit to the negative zone become split up into their elements, the chlorine parting and returning to the positive zone, whilst the gold is deposited on the negative pole in a fine metallic condition in the inner chamber. From this it is washed and drawn off in the contracted part of the inner chamber in conjunction with the caustic soda and passed through a filter. The powder is then calcined and the gold remains.

The gold having been extracted from the ore, the latter is drawn off at the bottom of the outer cell and an equal amount entering simultaneously at the top from a hopper, to which it has been mixed with the salt, makes the action continuous. In a working plant every ton of ore will be virtually from 20 to 24 hours under the chlorinating and electrical influence, and travel about [illegible]0 feet, which will give sufficient time for effective treatment.

As to the cost, adds the *Mining Standard*, it is estimated to be about one-ninth of the present cost of chlorination, or that 3s. 5d. per ton, should cover the cost of supervision and sinking fund for capital. The inventor estimates the outlay for a complete plant to be £250, exclusive of an engine to drive the dynamo.

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Improvement in the Manufacture of Mineral Wool.

A very important step in advance in the manufacture of mineral wool was taken some time since by the Western Mineral Wool Company. The production of mineral wool by the method long in vogue is to utilise the molten slag as taken from a blast furnace in the usual course of furnace work. This plan necessarily depends upon the operation of the blast furnace and when for any reason the blast furnace fails to supply the molten slag the manufacture of the mineral wool must stop. Another objection is that only a single carload of slag can be done from one run or flush of the furnace, which fact shows that the supply of material is necessarily limited. A third objection is the unevenness of the slag as it comes from the blast furnace. Much of the slag drawn fails entirely to make mineral wool or results in a product of inferior quality. The suitability of the molten slag can be determined ofttimes only by the results of the blowing and when the operations have been defective it can only be disposed of as waste. Accordingly, the run of the furnace is lost and time and labor are expended in disposing of the useless slag. Again, the entire slag product of some blast furnace, by reason of the nature of the ore used, is wholly unfit for the manufacture of mineral wool. And a fourth objection is that even where the slag is of correct quality, a large portion of each carload becomes cool before it can be used and the cool portion is lost. The inventor of the improvement mentioned that by mixing lime or silica, or silica-bearing stone, with the ordinary slag and fusing the mixture in a cupola, a constant supply of re-melted slag could be obtained from which a mineral wool may be produced of better and more uniform quality than is produced by the slag drawn direct from a blast furnace. At the same time each of the several objections above recited is overcome. Whether silica or lime, or both, shall be used depends entirely upon the nature of the slag. This, he explains, is readily determined by one or two inexpensive trials, and accordingly, it is in the power of the manufacturer to arrange this mixture to produce a perfect article at all times. At the works of the Western Mineral Wool Company, Cleveland, two cupolas are at present in use. It is found, by trial, that about twelve hours' run could be obtained from a cupola before the lining gives out. With two cupolas working alternately night and day a continuous run is obtained, and upon this plan the company are at present proceeding. In 1885, the first year of the company's business, 300,000 lbs. of mineral wool were produced and sold. In 1890 no less than 9,000,000 were manufactured and sold, while for the current year the output will be considerably greater.

A New Process for the Treatment of Ores.

(Mining Journal.)

A demonstration was given recently at Hutching's wharf, West Ferry Road, Millwall, London, E., under the auspices of the Atkins Amalgamator Syndicate, (Ltd.), of a new process for the treatment of gold and other metalliferous ores by electrolysis, which has a number of important advantages claimed on its behalf, and which, if the results stated hitherto to have been obtained may be taken as an average, would seem to have a future before it. The process, broadly speaking, is the same in the early part of the treatment of the ore as that generally adopted, the novel feature being introduced when amalgamation takes place. For this purpose a machine of somewhat original type is employed, and is, we understand, the invention of Mr. G. J. Atkins, under whose management the proceedings were conducted. At the works of the syndicate at Millwall, a complete installation of plant for the treatment of ores has been laid down, and samples of not less than a ton of ore may, we understand, be sent here for a trial treatment by mining companies who wish for visible proof of what the process will do. The ore is first put through an ordinary stone-breaker, and is thence conveyed to a five stamp battery to be further pulverised—these two items in the plant being made by the Chatteris Ironworks Co., of Chatteris, Cambs.

The material is next conveyed to the Atkins patent amalgamator. This apparatus consists of a vertical cylinder or depositing chamber, which, to use an electrical term, might be described as a large decomposition cell, in which electrolysis takes place. The crushed material, as taken from the stamps, is conveyed into the upper end of this chamber by elevators, and is fed on to a revolving broad-bladed carbon screw-conveyor about 7 feet long, which is placed vertically in the cylinder. While the exterior casing forms the negative pole of what we have for convenience sake described as a cell, this upright conveyor may be spoken of as the positive pole, which, it might be added, is constructed so as to be insoluble. The ore automatically passes down this screw by its own gravity, and in the course of its downward progress the refractory elements are electrically attacked by the elements oxygen, chlorine, or cyanogen according to the solution used, and the metals deposited upon the cylinder in a pulverent form, being thus put into a condition so as to readily amalgamate. The amalgamating part of the apparatus is situated at the bottom of the upright cylinder, but, before going on to deal with this in detail, it may be noted that during the process which takes place in the cylinder chlorine, oxygen, cyanogen and other elements are liberated by the chemical solution used in the cylinder and appear at the positive pole or carbon screw. This solution or electrolyte is not a costly one to produce. In some cases it is water only, and is adapted to the class of ore under treatment. Ordinarily a weak solution of common salt is, we understand, sufficient, and may be used continuously; it should also be noted that no previous roasting of the ore is necessary. The whole of the process hitherto described is quite distinct from, and takes place before the ore reaches the amalgamating part of the apparatus, the only condition necessary for its successful treatment being that it must be pulverized to a sufficient degree of fineness, the object of the inventor being to either dissolve all the gold or, in case of it being coarse, to cleanse it, so that it may be in a condition to be picked up in the amalgamating chamber. The gold that is dissolved is deposited upon the casing in a pulverized form, falls down to be picked up by the mercury, and is separated from the ore as it passes out of the machine.

The amalgamating part of the apparatus is, as we have said, situated at the bottom of the machine. It consists of a horizontal cylinder containing a finely corrugated revolving drum fitting close to its sides, into which the ore is carried direct from the vertical cylinder, under great pressure, and here meets a large quantity of clean mercury (forming part of the negative pole). Here it is revolved round the cylinder, still in its finely divided condition, and mixed up with the mercury until it reaches the outlet, the ore being eventually separated from the mercury, and forced out at the side of the cylinder, while the mercury with the gold it has picked up, passes out at the bottom, thence through a strainer, where the gold and silver is recovered, the clean mercury returning to the machine. Thus, as will be observed, the mercury is kept clean, and is constantly picking up the metals and parting with them in the strainer. The inventor further states that this machine will treat ores either by the chlorination, oxidation or the cyanogen processes, and is very economical inasmuch as the cyanogen or chlorine is recovered and can be used again. As will be seen it is extremely simple, and nearly automatic, gravity playing a great part in carrying the ore through the machine; and as the reagents are all recovered, with the exception of the small amount of solution actually soaked up by the ore, the cost is but small, and the wear and tear very little.

Several advantages may be enumerated as ranking among the most important of the many claimed for this process. The inventor claims that oxidation is sufficient in many cases to free the gold before amalgamation. This he claims to bring about in the vertical cylinder. When chlorination is required to dissolve the gold, this is also effected in the vertical cylinder and the gold deposited to be picked up by the amalgamator, thus dispensing with the ordinary method and plant used for chlorination, and also recovering the chlorine for further use. Filtration, etc., so fatal to ordinary chlorination plants, is also dispensed with. Where cyanogen is used for the recovery of both gold and silver the metals are deposited out of the solution in the vertical cylinder, thus recovering the cyanogen for further use, and making this rather costly salt come within the bounds of economy in practice. What the inventor claims is that he has a machine that can be adapted to any class of ore. Refractory ores can be treated without the heavy expense and delay involved in concentrating, roasting and smelting; free milling ores can be treated, it is urged, at much less expense and with greater certainty and better results than under the present system of amalgamation; float gold is recovered with practically no loss; the ore in all cases passes direct from the stamps to the machine, no other treatment being previously required; the machine being automatic in its action no delays are necessary for cleaning up; no portion of the precious metals can be abstracted without the knowledge of the person in charge, the amalgam being under lock and key. The amalgam can be removed without stopping the machinery. The process is specially adapted for situations where water is scarce, as a very small quantity is sufficient, and that can be used over and over again, and for use at mines where fuel is scarce or expensive, fuel only being required for steam power. Where water is available even at a distance no fuel is necessary, as all the machinery can be driven by electric motors. The plant can be taken to pieces and carried on the backs of mules, no portion weighing more than about 250 lbs. No expensive staff to work the plant is needed, and the cost of treatment is small per ton, even for the most refractory ores, whilst the advantages over processes requiring roasting are manifest both as regards labour and expense. Finally it is claimed that by this system low grade ores and tailings can be profitably treated. The machine, it is further stated, can be adapted to run entirely by water power, and the inventor will undertake to fit up a plant to run with electric motors, if water power is available within a reasonable distance. The following are stated to be a few of the results hitherto attained by the process of different samples of a great variety of ores: No. 1, refractory, ground 60 mesh, recovered 93 per cent.; No. 2, free milling, ground 30 mesh, recovered 92 per cent.; No. 3, free milling, ground 40 mesh, recovered 90 per cent.; No. 4, very refractory (Black Jack), ground 50 mesh, recovered 85 per cent.; No. 5 refractory, ground 50 mesh, recovered 91 per cent.; No. 6, tailings (N.Z.), assayed gold 11 dwts., recovered 8 dwts.; No. 7, tailings (U.S.A.), assayed gold 6 dwts., silver 7 ounces, recovered gold 3 dwts, silver 5½ ounces.

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A Simple Method for the Analysis of Coal or Coke.

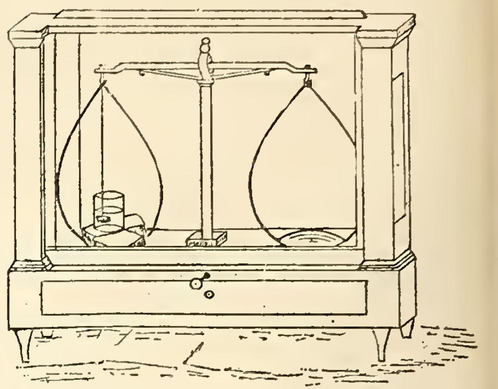
The following method has been used by a large British firm of coal consumers, and has been found to give results of quite sufficient-accuracy for ordinary purposes, without taking an unreasonable time to perform. We shall describe it in simple, every-day language, so that mining engineers and coal users may, with the necessary apparatus, perform approximate analyses for themselves.

Sampling.—This is a most important part of the operation, for, if a sample is taken which does not fairly represent the bulk, the subsequent analysis is of very little use. To obtain a true sample, take a shovelful from different parts of the heap, load, or consignment, say from opposite ends and sides, and from the middle. If the coal contains lumps of hard, slaty shale, as sometimes happens, see that a due proportion of this is included in the sample. The coal or coke thus sampled is next broken upon a cleanly-swept iron plate, or floor, and the whole mixed thoroughly; it should now be quartered, to reduce the sample to the required size.

Keep a few pieces for the determination of specific gravity, and pound the remainder in a mortar, with pestle, or on an iron plate, with a flat-faced hammer, to the state of a fine powder, and place a sufficient quantity in a clean, dry, corked bottle for analysis.

Specific Gravity.—This is not always required, but, as it is sometimes an advantage to know the specific gravity of coal (*i.e.*, its weight as compared with an equal bulk of water), we shall briefly describe the method of determination. This brings us to the consideration of a balance, suitable for the weighings required in finding the specific gravity and in performing the general analysis. In a case, such as that named above, where a mining engineer desires to make occasional reports on samples of coal, a cheap balance, which we have tried and can recommend, is that made by Becker's Sons, Rotterdam, and numbered 28 and 29 in their 1886 price list. It is mounted in a French-polished mahogany glass case, with counterpoised front sliding frame, movable pans, may be charged up to 50 grams in each pan, and is sensible to ½ milligram, with its full charge. Such a balance, provided with set screws and level, and fitted with agate knife edges, may be had for about £4 8s. (equals about $22). This price includes the extra charge made for agate knife edges, it will pay to get these as the cheaper steel edges are very liable to rust after exposure and use. The cheap set of gram weights, No. 28, in Beckers' catalogue, containing 50 gram piece down to 1 milligram, may be recommended, as of sufficient accuracy. They are supplied in a mahogany box, lined with cloth, each piece is fitted separately and the fractions of the gram are made of aluminum. The price of this set is 13s. (equals about $3).

To determine the specific gravity take a representative piece of the coal or coke of convenient size, say a piece of the shape of a rough cube, the sides of which are about half an inch. To the hook of one balance pan, attach a piece of thin thread, horse-hair, or platinum wire, of suitable length for suspending the piece of coal. The thread or wire must be counterpoised by a piece of the same size, or by weights, on the opposite pan. Now suspend the coal, find and note its weight in air.



Secondly, introduce the small beaker of cold distilled water (the temperature of which should be 60° Fahrenheit or thereabout), and find the weight of the coal as suspended in water. This method of determining specific gravities is based on the principle, discovered by Archimedes, that when a body is plunged beneath the surface of a liquid, it displaces a bulk of such liquid equal to itself, and is pressed upon or supported in the liquid with a force equal to that with which the particles of the displaced liquid were supported; the solid will consequently appear to have lost weight equivalent to that of the bulk of liquid which it occupies.

Having weighed a solid in air, as described, we find a weight which we shall call W, the second weighing in water gives us a weight W^1, and, from the above principle, the specific gravity will be the ratio of W to $W—W^1$.

Putting this in a simple formula, we get:—

$$\text{Specific gravity} = \frac{W}{W - W^1}$$

To take an actual case, where a piece of coal weighed in air, 3·628 grams and in water ·788 grams:—

$$\frac{3{\cdot}628}{3{\cdot}628 - {\cdot}788} = \frac{3{\cdot}628}{2{\cdot}840} = 1{\cdot}278 \text{ specific gravity of the coal.}$$

Moisture.—This is determined by heating 5 grams of the pounded sample (placed in a tarred watch glass) for half an hour, at a temperature of about 212° Fahrenheit, in an air bath. The portion should be allowed to cool and then re-weighed. The loss of weight multiplied by 20 will then give the percentage of moisture. If a sample of coal is heated for much longer than half an hour, at the above temperature, it gains weight, owing to oxidation. As some of our non-chemical readers may not understand the method of using an air bath, we had better, perhaps, explain that it is a small oven, made of japanned iron or copper, fitted with a hinged door in front. Through the top of this oven are two tubular holes, one for the exit and inlet of air during heating and cooling; the other holds a thermometer, fixed in, usually by a piece of cork. The oven rests on a four-legged stand of wrought iron, and is heated by a Bunsen burner placed under the centre.

Ash (*Silica, etc.*)—Weigh out 2 grams of the powdered coal, place in a crucible, preferably of platinum, or, if this is considered too expensive, nickel makes a fair substitute. Porcelain crucibles may be used, but soon crack with the heating, and hence are most costly in the end. Heat over the flame of a Bunsen burner till all the carbon and volatile matters are burned or driven off, and the residual ash is of a gray or white color. A clean wire may be used, occasionally, for stirring during the ignition. The weight of the ash multiplied by 50 gives its percentage proportion.

Volatile Matters (*Hydrocarbons*).—Weigh two grams of the sample in a tarred crucible (with cover), close the cover down and see that it is a fairly good fit, but not too tight. Heat over a Bunsen flame; in the course of a few seconds it will be noticed that the hydrocarbons, in being volatilized, impart a luminous flame to the upper portion. As soon as this luminous flame disappears, it may be considered that the volatile hydrocarbons are evolved, and the gas should then be at once turned off. Allow the covered crucible with its contents to cool, and then weigh. The loss of weight multiplied by 50 minus the moisture per cent. equals volatile matters per cent.

Fixed Carbon.—This is usually put in by difference. The percentage of volatile matters (including moisture) plus that of ash are deducted from 100·00, the difference then represents the percentage of carbon.

Sulphur.—The sulphur in coal exists in two forms, as iron pyrites (or ferric sulphide), and as calcium sulphate. The sulphur existing as pyrites, may be regarded as volatile on combustion of the coal, whereas that existing as calcium sulphate is fixed; but, for most purposes, it suffices to estimate the total sulphur, the percentage of which may be placed underneath the statement of analysis. The following method yields satisfactory results:

Take 4 grams of the pounded coal and mix in a platinum capsule (or other shallow crucible), with twice its bulk of pure calcium hydrate (slacked lime), by stirring with a glass rod and adding water sufficient to *damp*, without *wetting*, the mixture. Dry in the air bath, then burn off the carbon and volatile matters over the flame of a Bunsen burner. The sulphur in the coal is oxidized and combines with the lime, forming calcium sulphate, sulphite, etc. Now wash from the capsule into a beaker, and as oxidizing agent, add a saturated solution of bleaching powder in excess, or a solution of potassium permanganate, excess of the latter being denoted by the pink color remaining permanent after agitation. Boil the liquid for a few minutes, add pure hydrochloric acid in slight excess and continue the boiling till all soluble matter appears to have been dissolved, filter to separate ash, etc., wash, boil the filtrate, add a solution of pure barium chloride in excess. This point is indicated by boiling, and allowing the precipitate to settle, by removing the flame; if addition of more barium chloride solution cause no further precipitate, it is safe to conclude that an excess of the reagent is present. Having boiled for about five minutes, allow the precipitate of barium sulphate about an hour to settle out, in a warm place; filter through double filter papers, wash the precipitate till free from barium chloride (this may be shown by testing a few drops of the washings with silver nitrate solution, when no precipitate should form), now transfer the filter paper with precipitate into a platinum crucible, burn off over Bunsen till only the white precipitate of barium sulphate remains, weigh this: the weight × 25 × ·1373 (the factor to give sulphur, having found barium sulphate), = sulphur per cent.

Statement of Analysis.—The results are generally stated in the following form:

Sample of....Tons....Cwts. Coal from......Colliery.
Date..................

Fixed Carbon	65·80
Volatile Matter	23·55
Ash	9·00
Moisture	1·65
	100·00
Total Sulphur	1·25%
Specific Gravity	1·278

Sampling Ores without Use of Machinery.*

By William Glenn, Baltimore, Md.

The taking of proper samples of crude ores seems to be less thoroughly understood, or less carefully practiced, than its importance requires. We all know how often we encounter the reports of very accurate assays and analyses, the weight of which as evidence wholly depends on the method of obtaining the sample, and is very probably *nil*, because there has been no proper sampling. Passages may be cited from technical books, and from current technical literature (all the work of writers whom we delight to honor), to show that even among high scientific authorities there is too little acquaintance with the practical art of the sampler. There is no metallurgical or chemical establishment which does not frequently receive samples truly representing nothing. They consist usually of bits of ore, or what not, selected because they are worse or better than the average of what they are meant to represent. And they are worthless, no matter who made the selection. Where conscious choice is permitted to enter into the operation, a fair sample will not result, unless by a miracle.

The work of sampling is often looked upon as within the realm of boys and of pensioners only. At least, though the manual labor be left to subordinates, the principles on which it is conducted and the safeguards with which it is surrounded are not unworthy of the study of experts; and experts should be ready to teach these principles and enforce them in practice. For exact sampling is the indispensable first step towards learning the value of any boxful, carload or shipload of ore.

I propose to give a simple account of the method of sampling by hand, such as I have always pursued. There is nothing new about it. So far as I know, it is the immemorial old method, as old at least as Cornish copper mining. Perhaps my fellow members in the Institute may suggest improvements in it. If not, it will constitute a record in our *Transactions* to which laymen and beginners may be referred.

There are two principal processes to be considered: first, how to take the gross sample of the lot of ore; second, how to proceed with that sample. Really, there is no iron-bound rule governing the first step; each may have a way of his own; yet most samplers proceed in much the same way. But once having the rough sample, there is no question as to what shall be done with it. It is to be worked down after the orthodox fashion. It must be broken and mixed and quartered until only a few ounces remain. The sampler bottles this residue; the chemist does the rest.

Assume that we have a rough sample, weighing a ton, of any ore with its gangue. Assume that by some manner of magic we can at once reduce the whole of it to dust. Evidently, if we could mix it long enough and well enough upon a clean, tight floor, it would finally become homogeneous. In that case, we could fill half a dozen small bottles from any part of the pile, and they would be fair samples. But the work would have to be admirably done; so well done that a single gramme taken from the pile would properly represent the entire ton of sample. Really, this would entail a great deal of labor. And if the rough sample weighed 15 tons or more, as it would if taken from a shipload, the bare labor of mixing that quantity of dust until homogeneous is wearying even to think of. We cannot proceed upon the proposition that a final sample may be obtained in any such a way. Yet upon a rock similar to this many are wrecked.

To take, for illustration, a definite case, let us assume that we have to sample a 10-ton pile of 10 per cent. copper ore, prepared for market. It will consist of masses generally the size of one's fist, but of all smaller masses and even of dust. We shall require for the work a clean. tight floor or pavement, an iron mortar and pestle, a shovel, a small hammer, a piece of iron for an anvil and, lastly, a broom. Besides these, we shall find convenient a wheelbarrow or a barrel or box of some kind.

For convenience and force I will put my description into the form of homely directions, such as I might give to my workman.

Begin by shovelling the pile roughly into the form of a flattened cone or a flattened pyramid; say we choose the pyramid. Now make a trench straight through the pile, cutting it into two nearly equal parts. And again by a trench (at right angles to the first) divide these halves into four nearly equal quarters. A part of the ore taken from these trenches will form the sample required. Proceed as follows:

Having the wheelbarrow ready, begin at the middle of any side of the made up pile and cut the first trench. Cast the first shovelful to the right, the second to the left, the third into the wheelbarrow. Repeat this order of shovelling until the barrow is full, then empty it upon the well swept floor intended to receive the sample. Continue in the same way until the trench has passed through the pile, when there will result two rather long and narrow piles. Begin the second trench, extending it across the middle of the two piles, casting the first shovelful right, the second left, the third into the barrow. Proceed in the same way as with the first trench. When done, you will have shovelled about 6,000 pounds of ore. As every third shovelful was thrown into the barrow, there will result about 2,000 pounds of sample upon the floor. That this is a fair sample of the original pile is based upon the assumption that each third shovelful thrown into the barrow was like the first and second ones cast into the piles. The hypothesis is reasonable and freely to be trusted.

Having the sample, proceed with it after the regulation method, as follows:

Spread it thinly upon the floor; now examine it. If there be any lumps which look larger than the general run, place the anvil upon the pile, and between that and the hammer break those lumps. The next step is to thoroughly well mix the sample. Begin at one edge of it and shovel the ore over upon itself. Move around to the opposite side of the pile, and from that side shovel the ore again upon itself and back to its original place upon the floor. Having it well mixed, form it into a flattened cone and sweep all the dust upon and around the pile. You have now to halve and quarter the sample as follows:

Commence at any point and shovel a road through the center of the pile, casting the shovelfuls alternately right and left as you proceed. This movement will result in cutting the pile into two elongated nearly equal ones. Beginning at the middle of one of them, shovel a road through it in the same way as was done before. And in precisely the same way cut the other pile in two; sweep upon each pile the dust belonging to it. These movements will result in four piles, A, B, C and D.

If the sample were well mixed, when and as directed in these notes, then will each of the quarters, A, B, C and D, have the same composition as have all the others. But if, upon inspecting them, you judge one or another to be poorer or richer than the others, you will have then sufficient evidence that the work has been badly performed. In that condition of affairs, mix well together all the piles, and once more halve and quarter them. Having made all the quarters of the same composition, it follows that any two of them may safely be accepted as representing the original 2,000 pounds of the rough sample. This opens a road leading in the right direction, since it enables us finally to get rid of half the sample. We may cast out two of the quarters and retain the other two for the sample. It is a matter of indifference which two are retained, say A and B. Remove from the floor C and D, together with the dust belonging to them.

We have again to break the larger stones, until there remain none larger than walnuts. Place the anvil between the piles, within easy reach of them. Take a stone from A, break it; take one from B, break that. Continue in this way, taking stones alternately from each pile, until all are reduced to the size stated. By proceeding in this way, the sample is more or less mixed while being broken. Complete the mixing as before, by shovelling all of the sample forth and back over the floor. Form it once more into a flattened cone, and sweep the dust up and around it. Divide the cone into two halves, and those into four quarters, precisely as you before did. You have now to reject two of these quarters. The unwritten law of the sampler says that it must be those holding the positions A and B, because those were retained in the last quartering. Remove A and B from the floor, retaining C and D for the sample. These would now weigh about 500 pounds.

Proceeding as before, break down the lumps of ore until none are left larger than say 1-inch cubes. Again mix well the sample, make it into a pile, sweep up the dust, halve and quarter the pile. Reject two quarters (C and D, of course), retain two, precisely as in former quarterings.

Once more break the lumps, this time down to half-inch cubes. Mix well the sample, make it into a pile, sweep up the dust, halve and quarter, reject two quarters. The two quarters retained would weigh about 125 pounds. Break it down until comparable to fine gravel and coarse sand. Mix and quarter once more.

The two quarters this time retained would weigh about 60 pounds. With the mortar and pestle break this to something approaching coarse sand. Again mix and quarter. The quarters this time retained are to be ground yet finer, mixed and quartered.

If you have no mortar and pestle, the hammer and anvil may be substituted throughout. After getting the material into the form of coarse sand, it is best to mix and quarter it upon a sheet of paper, even an old newspaper.

At this point the sample would weigh about 15 pounds; its larger grains would be in size like coarse sand. It would be safe now, without further breaking, to mix and quarter it twice, or until its weight did not exceed 4 pounds. Run this through the mortar and then mix and quarter it twice, or down to 1 pound weight. Grind this to something approaching approaching powder, and, for the last time, mix and quarter it. Have ready 6 wide-mouth 1-ounce bottles. Place them in a line, side by side, upon a sheet of paper. From the other paper pour the ground sample in a small stream, forth and back across the mouths of the bottles, until they are all full up to their shoulders. Cork, seal and label them, and the sampling is done, and properly done.

If there should lurk in your mind a suspicion that this half-pound residue of dust may not, after all, properly represent the rough sample with which you began, go back over the work, and try to decide precisely where in the quarterings the sample retained ceased to be a sample. If you can decide upon that point exactly, then you will know just where you failed to do your work properly. The error will be with you and not in the method.

It does not, in the slightest, matter of what solid a sample may consist, or how much or how little it may be, it should be worked down in the manner just detailed. Whether a sample consist of 20 tons or of 1 ounce, it matters not, except as to breaking and grinding.

A word may be added as to larger and rougher ore-piles than have as yet been mentioned. It is not unusual for one to have a pile of 100 tons, or 200 tons, which one would like to sample. Such piles are apt to consist of lumps larger than a man's head, together with masses of all smaller sizes. Where a pile is formed by dumping ore uniformly upon its top, the likelihood is that the pile is homogeneous. In such a case, it is safe to make short cuts into it at several points around its base, and to consider as sample the ore so gotten. It is safer to make one cut through the pile, retaining as sample each third shovelful, as in the case of the copper ore we have just considered. In forming ore piles of the weights given, it is a good custom to put upon a separate platform each tenth or twentieth barrow load coming from the mine; the small pile will prove a fairly good sample of the large one. But no matter how it may be gotten, the rough sample is to be broken and mixed and proceeded with after the regulation method.

No account is here taken of moisture-samples, or of sampling train loads or ship loads. This paper is meant to help beginners, but it would be, in the writer's judgment, a benefit to others also, if our members who are practically acquainted with sampling would present their own methods with regard to the various branches of the art. The precautions specially required in sampling rich silver-ores, for instance, might well be made the subject of comparison and discussion.

DISCUSSION.

R. W. RAYMOND, New York City.—I am glad that this subject has been brought to the attention of the Institute. Mr. Glenn has by no means over-stated its importance; and yet, with the exception of the paper of Mr. D. W. Brunton (*Trans.*, xiii., 639) describing a mechanical ore-sampler, I can recall little or nothing in our *Transactions* concerning it. The practice in the West, with regard to silver ores, etc., is affected by various considerations. As a general rule, such ores are either already fine or are crushed before treatment. I think it is now generally admitted that a good mechanical sampler connected with the crushing machinery takes a fairer average sample (usually one-fifth or one-tenth of the total lot of ore, according to the richness and the consequent importance of exact determination of values as a basis of payment to the miner) than can be got by throwing aside the fifth or tenth shovelful in unloading. At all events, the mechanical sampler cannot be suspected of bias, conscious or unconscious, provided it is so constructed as to deliver impartially the coarser and finer particles of the stream of ore passing through it. Disputes are therefore avoided by using it.

But for many classes of ore, the sample is still taken with the shovel; and it is after this has been done, whether mechanically or by hand, that the process begins, which can properly be compared with that described by Mr. Glenn. The differences between this process and his are required by the following principal considerations:—

1. The material, namely, ores carrying, besides lead or copper, more or less silver and gold, is so much more valuable that small errors in determining its contents may be the source of large loss to the buyer or seller.

2. It is almost always finer than the crude material contemplated by Mr. Glenn. Either it has been crushed before the sampling begins, or it is so generally fine when received that the preliminary stages of sampling may be, in the judgment of the manager, performed without

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* Transactions of the American Institute of Mining Engineers.

crushing. This, however, always involves a risk, the assumption of which by a prudent manager is justified only when the conditions are favorable; for instance, when the character of the ore is well known; when its grade is not too high; when the difference in richness between coarser and finer pieces is not great; when careful experiment has shown that sampling without a preliminary crushing is sufficiently accurate; when avoiding the extra cost of crushing would be an important saving, or when the crushing machinery of the establishment is fully occupied with material which must be reduced before sampling. The nature of the contract between the smelter and the miner is another element to be taken into account. Perhaps the ore is not to be paid for strictly according to sample assay (a thing which now and then happens, though not often, in the purchase of large dumps at a round price, or the treatment of ores on joint account, to be settled by the net results, instead of the preliminary assays, or under special contracts, in which the loan of money or other inducement to the miner has secured special terms). Perhaps, again, the smelter owns the mine, and can thus afford to save current expense by taking some risks in sampling his own ore which he would not take with ore for which he had to pay according to the sample assay.

I think it may be said, however, that the sampling works proper, that is, those which are not parts of smelting-works, but stand between the smelter and the miner, as agents for the latter in the sale of ore, warranting to the purchaser the accuracy of their determination of its contents, always crush everything they receive. And I think it may be said, also, that when the capacity of crushing and sampling-apparatus is adequate, and the arrangements for receiving and handling ore are so perfect as to avoid both demurrage on railway cars and re-handling of material, the crushing and mechanical sampling of all lots received is not only better, but cheaper, than shovel-sampling of crude cargoes. The matter may indeed be left to the discretion of a competent manager; but the most competent managers are not anxious to multiply the matters which are left even to their own discretion, still less to the discretion of subordinates. There are innumerable things which have to be watched daily and hourly around great smelting works; and it is a relief when any one department can be placed in the category of comparative routine, calling for fidelity rather than discretion. Moreover, the exact determination of all the elements of an ore of the class here contemplated is as important on technical as on commercial grounds. Without it, the metallurgist can neither calculate his charges successfully nor be held responsible if he fails to do so. And the sample taken of each new lot of ore received is not only assayed for its valuable contents, such as lead, copper, silver and gold, and for sulphur, iron, silica and zinc (which may affect the price to be paid for it), but also analyzed for all its earthy bases, so that it may be properly mixed for smelting with other ores or fluxes. Now it is quite likely that the gangue minerals of an ore may break very differently, according to their natural hardness or cleavage, in the ordinary processes of mining and shipment. Moreover, the same car load from a given mine may contain ores from different stopes, varying so greatly in character and condition that even if the average of gold or silver were reasonably uniform, the average of silica, lime, magnesia, baryta, etc., would not be so, and the lumps might be entirely different in these particulars from the finer stuff.

With these digressions and explanations, I repeat the general statement that the ore to be sampled in the West is generally fine. But for the rough sampling of ore at the mine, or in localities where proper crushing cannot be done, the procedure described by Mr. Glenn seems to be a good one for the preliminary stages.

3. Notwithstanding the general fineness of the crude pile, and no matter to what degree it may have been reduced by crushing (short of the final reduction to impalpable powder), there is still a distinction between coarser and finer particles, and in the majority of cases this distinction is one of value as well as size. Many of our western ores carry silver, for instance, not only as an accessory ingredient of galena, but also in the form of finely-disseminated "true silver ores" accompanying the galena. These are usually not only in fine crystals or specks to begin with (often not distinguishable to the naked eye), but brittle besides, so that the shocks and abrasion of mining, transportation, crushing and handling reduce them to still smaller size. In the stamp mill they make "slimes." In concentration they are very likely to escape and leave the headings impoverished, though clean from gangue—"poor but honest," so to speak. In sampling, they present the greatest danger of error.

Something similar might be said concerning the tenor of gold in many ores. Although true gold ores are not common, yet in a lot of ore consisting largely of auriferous pyrites, for instance, there will certainly be more or less oxidized material, in which there is fine, free gold. I confess, however, that so far as my observation goes, this is not the source of as serious difficulty in sampling as are the brittle ores of silver. That is a point on which I hope some of our members who have had wider practical experience with the sampling of gold bearing ores will throw further light. My own knowledge comprises more particularly the practice of lead smelters; and in that practice the gold in the ores purchased, though it is determined and paid for, has not been hitherto a point raising special questions of difficulty. Or rather, the precautions taken as to the fine dust of silver ores cover the question of gold also, so that this has not called for separate consideration. Moreover, almost all the distinctively gold bearing ore of the country, as well as a great part of the silver ore, is reduced by wet crushing for amalgamation or other subsequent treatment, and consequently sampled by battery assays—a process which is not here under consideration, and which does not encounter the precise difficulty just described. I am inclined to think that in lots of crude fine ore, or of ore dry crushed for sampling, oxidized material containing gold would not present as much difficulty as silver ore, because it is less likely to form fine flying or sifting or rolling dust. The iron oxide tends rather to pack or adhere—at least to lie where it falls—unless it has been artificially dried and pulverized.

But the difference of value between coarse and fine particles may be due to other minerals than those already mentioned. And there may even be cases in which the greater value is in the coarser material. I need not however, enlarge further under this head.

4. Obviously such a difference would have no effect, if the whole mass to be sampled were so thoroughly mixed that the proportions of different sizes were uniform throughout. But this is not practicable, because the coarse and fine particles behave differently as to rolling and sifting over or through the pile upon which they are shovelled. Consequently, it becomes necessary, in order to secure a correct final average, to make the distribution of sizes in each pile formed *symmetrical*, since it cannot be made truly *uniform*. At a later stage, as will be seen, the whole of the sample thus secured is reduced to powder. Yet still the precaution of making symmetrical piles for quartering is continued to the last.

With these explanations I will describe the quartering of a sample of ore (say one-fifth or one-tenth of a gross lot), as practiced at some of the leading works in the West.

The mass is first shovelled into a ring on the sampling floor, and this ring is then shovelled toward the center, each shovelful being carefully delivered upon the summit of the pile in the center, so that they shall roll equally in all directions. A conical heap having thus been formed, it is pulled down and spread out. The workmen walk round and round the pile, pulling with the shovel, as it were, the ore towards them, so that it rolls outward. The lower six inches of the pile is not disturbed, and when this process is finished, the conical heap has become a truncated cone of larger base area and six inches height. This flat heap is now quartered by pressing a stick or a board held edgewise into it so as to mark the diametrical divisions. Two opposite quarters are cut out with the shovel and removed. The other two are again mixed, formed into a conical heap, and flattened out as before. This procedure is repeated until the quantity has been reduced to one or two wheelbarrow loads, when, if the material has never been mechanically crushed, it is crushed in the rolls to say half-inch maximum size. The quartering is then continued till the sample has been reduced to a panful. This is ground say to 60-mesh size (after a partial preliminary drying, if necessary to facilitate the grinding in a rotary fine crusher), and then taken to the assay laboratory, where it is thoroughly dried (say for twenty-four hours at 212° F.), and rubbed fine until the whole will pass through an 80-mesh sieve. Quartering is then resumed and continued until the sample is only sufficient to fill three bottles, one of which is for the assay of the works, one for the customer, and the third for the umpire assay, if such should be required.

The details of this practice may vary in different works, and I trust our members, many of whom are engaged in such work, will give us, in the way of criticism or suggestion, the benefit of their experience. It is perfectly evident, as Mr. Glenn says, that a vast amount of skill and precision is daily wasted by our chemists in the delicate analysis of samples that mean nothing. To cite a single instance, I have recently studied with much interest the various papers in our *Transactions* concerning the practical results of the magnetic concentration of iron ores. In Mr. Birkinbine's paper, presented at the New York meeting, there is a simple formula, by which he calculates from the percentages of iron in the crude ore, the concentrates, and the tailings the quantity of crude ore required to furnish a ton of concentrates; and he applies this formula in testing the comparative economy of different magnetic concentrators. But in several instances the actual quantities of crude ore, concentrates, and tailings have been reported, and they do not agree with the results of calculation by this formula. Now the formula is mathematically accurate, and there is no reason to doubt the accuracy of the chemical work. It follows that the samples, either of the crude ore, of the concentrates, or of the tailings, could not have been accurate. It is certainly to be desired that future tests of such work should include more thorough sampling, and that future accounts of such tests should include descriptions of the method of sampling employed. In the absence of certainty as to the fundamental data, the application of mathematics to the discussion of results seems to be labor thrown away.

◆

Shipment of American Charcoal Iron to Europe.—In its review of the iron market under date of 17th July inst., the New York *Engineering and Mining Journal* says: "The news bureaus have reported the shipment of 400 tons of iron from Detroit, Mich., to Liverpool, as the first contract ever recorded for the carriage of American pig iron to Europe. This is erroneous. As a matter of fact there is nothing new in this shipment, several lots having gone from this port in the past two or three years. The iron shipped is a charcoal iron of superior grade, used by an English manufacturer near Liverpool for special purposes." The price of Swedish charcoal pig iron, of which there is a yearly consumption of some 30 to 40,000 tons in Great Britain, has been put very high by the great increase in the cost of charcoal during the past two years.

The Miner.

Where nature's crucible, long years ago,
Wrought the black miracle called anthracite,
Beneath earth's crust a thousand feet or so,
The miner delves in everlasting night,
A dim and flickering flame his only light:
And though, in many a guise, grim death is near,
Unseen and terrible, alert to smite,
The patient worker gives no heed to fear;
His heart is thrilled with thoughts of wife and children dear.

The scars of toil are on his manly face,
And show the marks of powder and of coal
That robbed his visage of its youthful grace,
But cannot leave their impress on the soul.
He may not write his name on hist'ry's scroll,
Yet he is none the less a perfect man,
Who acts his part in life, from start to goal;
Who does the work he finds, as best he can,
And leaves behind a record, earth and heaven may scan.

His modest shanty on the bleak hillside
Is rugged virtue's home. Within its walls
Domestic peace and happiness abide,
And discord's baleful shadow never falls.
The cares that often kill in palace halls,
The gilded miseries that smite and slay,
The greed for gold and grandeur which enthralls
So many hearts, o'er his exert no sway.
He envies none; his home is like a summer's day.

Yet, though his simple home is free from strife,
And at his hearth tranquility is guest,
The perils that beset the miner's life
Might fill with dark dismay the stoutest breast,
As the long lists of "fatal accidents" attest.
The dismal workshop where, amid the gloom,
He toils at stern necessity's behest,
Within a twinkling may become his tomb;
And every sturdy blow he strikes may sound his doom.

A spark some ambushed terror may awake
And set the fire-damp's fearful breath ablaze
With wrath that makes the busy valley shake,
And mocks the thunder of midsummer days
Which round the mountain's cloud-capped summit plays.
It snaps the stalwart pillars, and in piles
The slain are heaped among the winding ways;
Along the blighted corridors, for miles,
The fiery tempest sweeps the subterranean aisles.

Then, through the mining hamlets, white-faced fear,
Like some fierce simoom of the desert, flies,
Speeding the grief that cannot shed a tear—
Piercing the air with stricken women's cries
For those on whom they'll never feast their eyes.
And, while the sorrow-laden voices swell
Upon the breeze, and lamentations rise,
The panic-stricken people rush pell-mell
To that dread pit whose mouth is like the mouth of hell.

Who, in that dreadful moment, will essay
To risk his life and all that life endears
For those who feel the palsy of dismay?
Aye! there are scores of hardy volunteers,
Who bravely fling aside all human fears,
And down the yawning gulf, whence Hope has fled—
Where naught but certain, stern-faced Death appears
In all his hideous livery of dread—
They go to save the living or to join the dead.

Heroes who risk their lives in glory's blaze
Become immortal 'mid the world's applause;
And grateful nations sing the ceaseless praise
Of those who die to serve a noble cause,
And shed their blood to blot a tyrant's laws:
But the brave miner, heedless of renown,
Scorning a fate would give the bravest pause,
Descends the deadly pit where dangers frown,
And for his fellow-man his precious life lays down.

O cruel mines, that maim and crush and kill!
The dazzling wealth ye yield cannot atone
For all the pain ye give; the souls ye fill
With grief; the orphan's and the widow's moan,
The loving mother's deep despairing groan,
And all the untold misery ye make.
But God is ever mindful of His own,
And heeds each loving heart the coal mines break,
And all the precious lives their grim disasters take.

John E. Barrett in Belford's Magazine.

◆

An Electric Power Hammer.—An electric power hammer has been devised which represents a radically new application of electro-magnetic principles. The novelty of the apparatus lies in the substitution of electro-magnetic power for steam, by a slight and very simple modification of the mechanism. The piston is of magnetic material, and the cylinder is composed of a series of coils, through each of which an electric current may be passed separately.

MINING NOTES.

[From Our Own Correspondents.]

Nova Scotia.

Pictou County.

The six foot seam at the Vale colliery is in trouble from the large increase in water struck some months ago.

Our correspondent writes: "The Foord pit has to-day the finest pit bottom in Nova Scotia. The management has completed the brick arches, which extend several hundred feet on each side of pit bottom, supported by heavy steel rails curved to shape of arch and built in with brick. Now that bottom has been completed, the management has started construction of a new pit head, chiefly to be built of iron and steel. Surveys are being made to start the stone drifts. These new workings when completed will unquestionably make the Foord pit the best mine in the province. Your readers will understand that the Foord pit is over 3,000 feet from crop, or say 1,000 feet vertical. A slope is driven from crop of Cage pit seam some 1,800 feet; this seam underlies the Foord pit seam."

The management is preparing to sink this slope, and in the Foord pit drive across the measures and catch the Cage pit seam, then drive up and meet the sinkers. This will give them a very large body of good coal. It will take considerable time to make connection, but when made the Cage pit seam can be worked without steam, all the water running to big pump at bottom of Foord shaft.

The Douglas slope which is connected with the Cage pit further west than where the connection will be made with the Foord pit, is also connected with a four foot seam of superior coal. It is reported to be the intention to work this by long wall.

The MacGregor pit is working along with little or no variation.

At the Drummond colliery the principal work is drawing pillars, except in the 4,000 feet lift, where levels are driving east and west. The manager is having considerable trouble to get his pillars along the old "crush," which inclines to throw over on the new coal. The new large hoisting engine has not started up yet for reasons only known to the manager and builders.

The Acadia is idle for a week or so shifting plant down to 3,600 feet level. The new engine here is working very well.

It is reported that the Acadia Coal Company has acquired the Black Diamond property, principally owned by New Glasgow people.

The outlook for the Londonderry iron mines is not bright. It is said that the rolling mill is to be shut down for an indefinite period very shortly, and that 90 miners—nearly half—were discharged from the new mines lately. The known supply of hematite seems to have been exhausted; inferior ores from other parts of the province are being substituted; orders for iron are scarce, and a great deal of dead work in prospecting seems to be necessary.

Cumberland County.

Work is brisk at Springhill. The management has developed some new workings this summer with good results; they have sunk on another seam south, and it has proved of superior quality.

The management of the Joggins continue long wall working with success. A diamond drill has lately been put in to test some of their property at Maccan station.

The Lawson mine is now working some 20 men; this property is well situated, and yields coal of an excellent quality.

Beaver Dam.

Mr. Turnbull is reported to have sold his interests in this district to New York parties. On this account work in the mine has been suspended, but it is likely to be resumed again as soon as the reorganization is perfected.

Darrs Hill.

The management of the Dufferin Co. have under consideration the matter of equipping their mine with an air drill plant, to be operated by water power. As is worthy the biggest gold mine in the province, the matter is being considered in all its *pros* and *cons* before any conclusion will be reached.

Gay's River.

The Coldstream Co. is very quiet; no reports of dividends being declared have reached our ears yet.

The momentary excitement caused by the reported discovery of silver ore at Carroll's Corner has decidedly abated since assays refuse to show the presence of any silver.

One of the best arguments that can be used in favor of the establishment of technical schools, are these occasional flurries of excitement which are raised by people absolutely ignorant of mineralogy.

Lake Catcha.

The Oxford Co. is working steadily away, and have nothing but words of praise for the air compressing plant put in by the Canadian Rand Drill Co. last winter. The narrowness of the lodes, and the badly faulted character of the same, give the management plenty of problems to solve.

The ten stamp mill erected in Chezzetcook by Mr. John H. Anderson, for crushing quartz from his own property and from tributers, is nearly completed and will start up in a few days.

Malaga.

The Parker-Douglass Co., the Molega Co., and the Boston Mining Co. are all running steadily and with a good product.

The district has recovered somewhat from the disastrous boom of the last two years, and has settled down to steady and regular work. The district is a good one, and needs only legitimate work to make it second to none.

Oldham.

Dominion Day was celebrated here by the starting of the first Standard Pelton Water Wheel that ever came into the Dominion. The wheel referred to is a standard 6 ft. wheel operating under a head of 76 ft. 8 inches, with an average quantity of about 365 cubic feet of water per minute. Under these conditions the wheel develops 40 h. p., and is used for prime mover in the new stamp mill of the Oldham Gold Co. The water is carried in a ditch for 1,000 feet, and thence to the wheel by 500 feet of 16-inch sheet iron pipe. The results have been extremely satisfactory, the power developed being far in excess of present requirements. This mill (of which we hope to present a full account in a future issue), has another novel feature for Nova Scotia in the shape of a Foster Rock Breaker.

Renfrew.

This district promises to be a little livelier this year. Preparations are making for the thorough examination of the old workings of the north and south Ophir lodes, which in times past were the heaviest producers in Renfrew.

Waverley.

Capt. McDuff, of the Nova Scotia syndicate, reports a strike of good ore in the Dominion lode at a depth of about 80 feet. The mill has been refitted and alterations made in engine and boiler, whereby a saving of 50 per cent. is made in the fuel. The shaft in the Union lode is still sinking.

The Lake View Co. announce that their ore is too lean to pay, and contemplate closing down. Over $120,000 has been expended on the property.

The Sophia Mining Co. have abandoned all work except that of pumping out the Tudor lode. Progress has been reported good until the last month, when owing to increased depth or other causes the progress has been slower.

The West Waverley Gold Co. have completed foundations and have commenced the superstructures of their mill and other buildings. The whole plant has been designed and arranged with a view to fuel economy, the ores being of so low a grade as to demand strict economy in every department. The mill engine will be a tandem compound condensing. The air compressor is a duplex compound condensing one, and is building by the Canadian Rand Drill Co. from designs by Mr. F. A. Halsey. The Jenckes Machine Co. furnish the mine outfit of hoist, skips, cars, &c., and Matheson, of New Glasgow, furnishes the boilers, which are to carry 125 lbs. to the square inch.

Quebec.

Lievres River.

Complete surveys of all the properties of the General Phosphate Corporation have been made by Mr. E. Rainboth, and topographical maps are now being prepared with a view to obtaining estimates for laying in a permanent plant at High Falls and Ross Mountain. Whether the motive power will be steam transmitted by air pipes or utilized and applied by electric transmission is now under consideration. This is rendered urgent by insufficient water for the boiler power on Ross Mountain. The output has been low of late, partly on account of this, but the exploratory works so far done have proved the deposits to be extensive and permanent. It remains therefore, to work them on a large scale in order to arrive at a reduction in the working cost.

The output from the mines at High Rock, operated by the Phosphate of Lime Company, continues highly satisfactory. During June, the quantity shipped was close on 600 tons, while this month it promises to be quite as large if not larger.

We understand that the sale of the High Rock property to the General Phosphate Corporation is very nearly completed. If it is made, being adjacent to the High Falls and Ross Mountain properties, it will furnish valuable water power.

Mr. Twidell is opening up some valuable pits to the north west of Cap Rock pit, which are evidently a continuation of the main deposit. The present output, by this discovery, is raised quite to the average although the old No. 11 pit shows a temporary falling off.

It is regrettable that the Bell Telephone Co. have abandoned their project of putting in telephone connection this year up the Lievres River, on account of their not having received as many signatures as was anticipated.

Eastern Townships.

At the Leeds copper mine (the old Harvey Hill), the 20 fathom level driving west of shaft is being pushed on as fast as possible; the vein continues good, 3 ft. 6 in. wide, producing 2½ tons of 15 per cent. ore per fathom. No. 1 Slope in the back of the 20 fathom west continues in bed vein 2 feet 6 inches wide producing 2 tons 15 per cent. ore per fathom. No. 2 stope in the back of the 20 fathom level continues in bed vein 6 feet wide producing 3 tons 20 per cent. ore per fathom. Henwood's stope in the bottom of 20 fathom level west is in a splendid vein of ore 2 feet wide producing 2½ tons 40 per cent. ore per fathom. The 15 fathom level driving west of shaft is in bed vein 3 feet wide producing 1½ tons 15 per cent. ore per fathom. No. 1 stope in the back of the 15 fathom level is in bed vein 4 feet wide producing 2 tons of 15 per cent. ore per fathom. No. 2 stope in the back of this level is in bed vein 2 feet 6 inches wide producing 2 tons 15 per cent. ore per fathom. No. 3 stope is suspended. The drift in McGee's shaft is without change; still meeting good bunches of ore; a good quality of ore is being sent up from No. 1 stope in this part. In the adit, a party of men have been started on No. 2 bed. These are producing some good ore, but the bed is irregular. Two men have been started on a place known as Kent's bed. On the surface all work is being rapidly pushed forward and the crusher is about completed.

Templeton District.

Mr. Lomer has shipped during the present month from "The Big Mine" 700 tons No. 1 phosphate by barge, and about 400 tons by rail. The former to Montreal for the German market, and the latter to the Buckingham mill.

The Netherlands Co.'s two principal pits are developing unusually well during the past four or five weeks. Their prospects for a good season's output are encouraging.

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SEE THE INGERSOLL ROCK DRILL COMPANY'S ADVERTISEMENT
☞ ON BACK COVER. ☜

Mr. C. Koenig sails for London in a few days. Mr. Cirkel remains in charge of the asbestos mine. The output of the main shaft has been very good so far this season. In drift No. 3 the first good vein was struck last week.

Mr. Thomas Fee has shipped eight cars No. 1 phosphate to Liverpool this month, through Messrs. Wilson & Green, Montreal.

The old Templeton and North Ottawa Mining Co.'s "Fidelity Mine," lot 12, in 11th Range, has been acquired by Messrs. McRae & Co. Ten men have been employed since the 15th. On the "disputed show" a steam boiler with hoist and drill will be installed shortly.

It is reported that Messrs. Mutchmor & Gordon have purchased three lots on McGregor Lake, for the O. M. Co. Consideration, $6,000.

About 300 tons phosphate were taken out from the big show at McRae & Co.'s mine, lot 11, in 5th Range, during July. The diamond drill is again at work on that property, and in a few days an electric drill, hoist and lighting plant will be running. The wires are strung and all the plant, with the exception of the hoist, is now installed. Mr. O. S. Wheeler, of the Edison Co., has charge of construction.

Mr. Lewis McLaurin is reported to have struck "something big" recently on lot 11, in 12th Range.

Owing to flooding of the big pit on the property of the McLaurin Phosphate Syndicate, undeveloped shows on other portions of the property are now being opened up. One hundred tons or more were shipped during July.

The Mining Inspector for the County of Ottawa, intends prosecuting all parties not complying with the provisions of the new law respecting abandoned pits. The Government are bound to protect the poor farmers' cattle and the inspector likewise. ($25 in each abandoned pit to the inspector and $25 for the Court.)

Mr. J. Obalski, M.E., Government Engineer of the Province of Quebec, a few days ago visited the asbestos mines of this district.

The MacGregor Lake Phosphate Company have shut down on the Benson Lot, and intend shortly to transfer their plant to the Gore, arrangements having been about concluded to work on some of Mr. W. A. Allan's properties there.

Branches of the telephone to the McRae and to the Templeton Asbestos mines are now being put in. The Bell Company will have their line through Buckingham and Templeton completed in three or four weeks, when mining men may talk with Ottawa and Montreal.

Messrs. Fissault & Lepage are working about 22 men on their lots in the 4th Range. Their winter output is still unsold.

The Canada Industrial Company has commenced drawing their output, some 125 tons, to the Templeton Station, C.P.R.

Wakefield District.

Mr. A. T. MacIntyre has purchased lots 5, 6 and 7 in the 2nd Range of Masham from Mr. John Hyde. Seven men, under Prospector Holmes, are employed stripping and testing the shows.

Mr. Thos. Poston, Inspector of Revenue, Quebec, in company with Mr. Sims, of Aylmer, local collector, visited all the working mines in the County of Ottawa about the middle of the month. The Provincial Government intend exacting the license fee of $150 per annum from all works carrying more than 25 lbs. of explosives. A movement is on foot for the establishment of two central magazines in the Township of Templeton, from which miners in the vicinity may be supplied daily with their requirements, and thus escape this odious and objectionable tax.

Pontiac County.

The Bristol iron mines have been shut down for the present, as some 10,000 tons of ore have been got out, and there is no room left to store any more. Considerable additions to the plant are being made in the shape of two roasters, crushers, and an elevator. This will, when completed, have a capacity of about 100 tons per day. The intended output of the mines will be from 2,750 to 3,000 tons per month.

Ontario.

Port Arthur.

A rich find of silver ore is reported to have been made near Port Arthur by an old farmer named Henry Parsons, living in the township of Paipoonge, some ten miles west of here. A year ago Parsons bought the then owner's free grant claim of lot 19, 2nd concession, for $100, and after a while raised the money to pay the necessary $2 per acre for a patent as a mining location. His explorations soon bore fruit, for a short time ago he came to Port Arthur with some very rich samples of native and black silver, equal to anything ever found in the district. He has, it is said, been already offered $100,000 for his claim. The previous owners bitterly regret their lost opportunities, and the whole neighborhood is taking mining rights.

Sudbury.

The Canadian Copper Co. are now shipping a very large order of matte to the Oxford Copper Company of New York, to be refined, after which the nickel will be used in the manufacture of nickel-steel armour plate for the United States Government. The contract calls for 4,000 tons, equal to about 3,200,000 lbs. of fine copper and nickel, valued at about $300,000. This will clean out all but about 3,000 tons of matte in the company's yard, and brings this year's shipments to over 5,000 tons so far. Before long the new Bessemerizing plant will be at work, the three convertors now being put in position, and the boilers, cupola furnace, hydraulic cranes and accumulators being already in place.

British Columbia.

Kootenai.

The owners of the Wild Cat, a gold claim about half a mile southwest of the Poorman, packed 18 tons of ore for a trial run to the Poorman mill recently. The result of the clean-up was so satisfactory that a contract was made immediately for extending the tunnel another 50 feet. Later on a shaft will be sunk on the ground and if the result of this additional development work prove satisfactory, machinery will be placed on the mine and a mill erected near the mouth of Sandy Creek.

The Boulder hydraulic claim on 49 Creek has been purchased by Messrs. H. F. Keefer, D. McGillivray, R. G. Tatlow and R. C. Ferguson, from Messrs. A. L. Davenport, M. C. Monaghan, Barker Bros., N. Riopelle and J. P. Lamotte. The price is said to have been $2,000. The claim is believed to be a good one, and will no doubt give good returns if systematically worked. The ditches are being cleaned out and operations will shortly begin in earnest.

Superintendent Cronin has been taking a look at the Davenport-Henry properties in Toad Mountain and Hot Springs before beginning work on any of them. Some delay has been occasioned in beginning work on the Poorman by the desire of neighboring claim owners to make trial runs of ore at the Poorman mill. Mr. Cronin is of opinion that the people in this vicinity place too low an estimate on the benefit that the country will derive from the building and operation of the Columbia and Kootenai railway. He said, judging from the results in the Cœur d'Alene country, that the railway will not only make the profitable working of many of the mines possible, but that hundreds of people will now visit the camps on the lake who would never think of doing so had they to travel over wagon roads and trails.

Three assays of samples of ore from a claim discovered by C. C. Sproule and George Long, in the Goat River district, gave returns of over $100 to the ton in silver, besides large percentages of lead and some copper.

About three miles south of Nelson, Fred Sutter is at work on a strong outcrop of mineralized rock. The ledge is from four to sixteen feet wide, and apparently runs east and west, the vein matter being quartz carrying gold, silver and lead. The ground is favorably located for working. The west end stake is within a few feet of Giveout creek, the claim running up the side of a mountain, whose slope is not less than 65 degrees. Marks & Van Ness have an interest in the ground, and they intend spending money on it to prove its wealth.

CANADIAN COMPANIES.

Bell's Asbestos Company, (Ltd).—The directors have declared an interim dividend of 2s. 6d. per share, free of income tax, for the half-year ended June 30, being at the rate of 5 per cent. per annum, payable by warrant on and after the 31st ult., to the shareholders on the register on the 25th ult. Last year 10 per cent. was paid.

The LeRoi Mining and Smelting Company.—This company has been registered under the British Columbia Act relative to foreign companies, for the purpose of carrying on the business of mining, smelting, milling and reduction of ores of all kinds; to buy, sell and deal in mines; to work same, and to erect plant of all descriptions for the above purposes. Head office, Trail, B.C. Capital stock, $2,500,000, in 500,000 shares of $5 each.

The Provincial Chemical Fertilizer Company, (Ltd).—Application will be made by the above company for incorporation under New Brunswick laws, for the purpose of carrying on the business of manufacturing fertilizers, the buying and selling of the same, with all other matters incident thereto. Head office, St. John, N.B. Capital stock, $50,000, in 500 shares of $100 each. Applicants, R. W. Patterson, New York; De B. Caritte, St. John; S. G. Olive, St. John; W. W. McLauchlan, St. John; and C. A. Stockton, St. John, of whom the first three are to be the first directors. Solicitor, C. A. Stockton, St. John.

The Canadian Natural Gas Company, (Ltd).—Application will be made to the Federal Parliament for the incorporation of the above company for the purpose of acquiring and dealing in lands in the Dominion; the boring for, and obtaining in any way natural gas, oil, salt or any other natural commodity; to construct pipe lines; to erect plant for refining, warehousing, etc., with all other customary powers. Head office, Sherkston, Welland Co., Ontario. Capital stock, $100,000, in 5,000 shares of $20. Applicants, S. Carroll, Sherkston; W. E. Carroll, G. Bork, G. Lang, J. Binz, A. W. Hickman, and E. G. S. Miller, all of Buffalo, N.Y.; and H. Cornmiller, Port Colborne, Ont., of whom S. Carroll, J. Binz, and H. Cronmiller are to be the first directors.

The Canada Company.—At the annual meeting of the Canada Company in London, on the 25th ult., Sir R. Gillespie presiding, a dividend of 17s. 6d. was declared for the current half year. In July 1890, 10s. was paid, and in January of this year £1. There were on hand £7,755, out of which dividends to the amount of £7,279 were paid, leaving a balance on hand of £476, which with unclaimed dividends, amounted to £1,433. In the period from the 1st of January to the 28th of May, 357½ acres of land were sold, at an average of 37s. 7d. per acre; while 4,599½ acres were leased (with the option of purchase) at an average price of 78s. 5d. In the same period of 1890, 425 acres were sold, at an average of 78s. 4d., and 1,503 acres were leased, at an average of 69s.

Sydney and Louisburg Coal and Railway Company, (Ltd).—The annual general meeting of the shareholders of this company was held in London on the 30th ult., Mr. G. W. Medley presiding. In 1890, 155,900 tons of coal were mined, against 121,600 tons in 1889, and 124,050 tons in 1888. The increase in the business of the company necessitated considerable outlays. Mining rights have been acquired over a large area; the Emery mine has been opened up; dwelling houses have been erected; an engine and fifty coal cars bought; and the whole plant put in good repair. This cost altogether £7,810. Owing to these disbursements, of which a large part has been debited to revenue, only £1,715 9s. 6d., has been carried to profit and loss account against £3,618 18s. 2d. in 1889. The balance of profit and loss account brought forward on 31st December, 1889, after payment of a dividend of 12s. per share on the 5,000 first preference shares, was £1,836 5s. 2d., which added to £1,715 9s. 6d. as above, leaves an available balance of £3,554 14s. 8d. Out of this sum, a dividend of 12s. per share—equal to 10 per cent. on the first preference shares, was recommended and carried, leaving a balance of £554 14s. 8d. to be brought forward. The outlook for the current year is remarkably good and the directors expect to present a still better report next year. The directorate is unchanged, the retiring directors being re-elected.

The Cookshire Machine Works Company—This company is applying for incorporation to the Quebec Legislature, for the purpose of manufacturing machinery and carrying on a foundry and general business. Head office, Cookshire, Compton Co. Capital stock, $30,000, in 600 shares of $50. Applicants, H. Sawyer, W. W. Bailey, L. J. D. Gauthier, R. H. Pope, Township of Eaton; and F. H. Sleeper, Township of Compton, all of whom are to be the first directors.

The Beauce Asbestos Company.—Application will be made to the Quebec Legislature by the above company for incorporation, in order to deal in asbestos in the region of Beauce, and elsewhere in the Province of Quebec. Head office, Parish of St. Francis, Beauce County. Capital stock, $10,000, in 100 shares of $100 each.. Applicants, J. Godbout, St. Francis; Hon. J. E. Robidoux, Quebec. Hon. C. E. Langelier, Quebec; Hon. L. P. Pelletier, Quebec; W. H. B. C. de Lery, T. Fortier, P. Angus, C. Fortin, P. F. Renault, L. Mathieu, all of St. Francis; all of whom, except L. Mathieu, are to be the first directors.

The Ontario Mining Stock Exchange (Ltd).—This company will apply for incorporation under Ontario laws, for the purpose of maintaining a Mining Stock Exchange for the mutual convenience of those engaged in the business of dealing in mining and other stocks and securities; and for the promotion of just and equitable principles of trade, etc. Business to be carried on in the County of York. Head office, Toronto. Capital stock $50,000 in 500 shares of $100 each. Applicants, J. A. McAndrew, M. McConnell, S. F. Kilgour, W. B. Stephens, C. E. Burns, F. M. Holland, E. Porter and T. G. Clark, all of Toronto; all of whom are to be first directors.

General Phosphate Corporation (Ltd.)—Reports current on this side say that the company has succeeded in placing its debentures. Mr. Wills, the manager, states that while he has received no specific information on the subject, the company is well in funds, which argues the success of the issue.

Templeton Asbestos Mining Company (Ltd.)—The first ordinary general meeting of this company was held a short time ago at Winchester House, London, E.C. Mr. R. Wissman, who presided, after stating the progress made in the exploring work of the property, which was taken over in April, said that their policy was to spend as little money as possible before a mature plan of working could be formed, and only machinery absolutely necessary had been ordered. All their expenses in Canada, including machinery, rails, trucks, and two large boilers, amounted up to date to about £1,200, while the London expenses were practically *nil*. The asbestos raised has been described as magnificent, and the serpentine on the property was of a specially pure character, and it was estimated that there would be a profit of £3 per ton on this after paying for grinding, packing, and freight to London. Mr. Cirkel, their engineer, said in his report that he would not commit himself to the statement that asbestos existed in paying quantities, but they had received a cable from him which was of a satisfactory nature. They now awaited his detailed report before sanctioning the further expenditure of £2,000 on machinery. Replying to shareholders, the chairman said they had a good deal more than sufficient money to buy the machinery. All the purchase money had been paid, and they had money safe in the bank in Montreal.

H. W. McNeill & Co., (Ltd).—Application will be made by the above company for incorporation under Dominion laws, for the purpose of mining and extracting coal, especially anthracite coal, in the Dominion of Canada, and generally to carry on the business of colliery proprietors, miners, and engineers, in all branches; to mine, quarry, raise and treat, smelt and reduce, coal, coke, lignite, sandstone, granite, iron, gold, silver, copper, and other minerals, with all other customary powers. Head office, Anthracite, N.W.T. Capital stock, $50,000, in 500 shares of $100 each. Applicants, H. W. McNeill, Anthracite; F. A. Hill, Seattle, Wash.; D. R. Reeve, Anthracite; W. A. McNeill, Oklahoma, Ia.; Archelaus Pugh, St. Paul, Minn.; J. M. Platt, Island of Anacertes, Wash.; of whom the first three are to be the first directors.

The Peterborough and Frontenac Mining Company (Ltd.)—Application will be made for incorporation by the above company, under Ontario laws, to acquire and deal in mining claims and lands in Ontario; to work the same, to smelt and refine minerals, and generally to carry on a mining business in all its branches. Head office, Peterborough. Capital stock, $10,000,000, in 500,000 shares of $20 each. Applicants, J. W. Taylor, T. Brooks, G. Stevenson, W. H. Manning, A. E. Dixon, F. J. Bell, C. A. Weller, A. P. Poussette, G. W. Hatton, A. V. R. Young, T. E. Bradburn, A. Elliott, R. P. Boucher, H. Lebrun, J. W. Fairweather, W. Croft, J. E. McIntyre, E. A. McIntyre, all of Peterborough, Ont., of whom the first twelve are to be the first directors.

The Montreal and Kootenay Mining Company (Ltd.)—Application will be made by this company for incorporation under Federal laws, to purchase and develope gold, silver, copper, lead, asbestos, phosphate, mica and other mines throughout the Dominion, and to carry on the business of dealers in minerals generally. Head office, Montreal. Capital stock, $20,000 in 20,000 shares of $1 each. Applicants, E. B. Greenshields, P. A. Peterson, R. W. Smith, F. Fairman, W. H. Irwin, G. Hanson, and R. T. Hopper, all of Montreal; all of whom are to be the first directors.

The Reid & Currie Iron Works Company (Ltd.)—The above company is applying for incorporation under British Columbia laws to purchase and acquire from Messrs. Reid & Currie the foundry, blacksmith, machine and iron works and agency business carried on by them in New Westminster, B.C., together with all the plant, contracts and assets and liabilities, etc., to manufacture all kinds of machinery, steam and other fittings, and generally to do a machine and foundry business in all its branches. Head office, New Westminster, B.C. Capital stock, $100,000 in 1,000 shares of $100 each. Applicants, J. Reid, W. Currie, H. H. Newington, D. S. Hennesey, H. J. A. Burnett, and L. P. Eckstein, all of New Westminster, B.C., all of whom are to be the first directors.

The Nanaimo Coal Trimmers' Protective and Benevolent Association—Application will be made by the above society for incorporation under the "Benevolent Societies Act of 1891" of British Columbia, for the purpose of making provision by means of contributions, subscriptions and donations against sickness, unavoidable misfortune or death, and providing means of social intercourse, mutual helpfulness and mental and moral improvement. The number of trustees shall be six, viz.: J. Durken, J. Lloyd, J. Wilson, W. Meyers, G. Maunder and H. Striethorst, who are to manage the affairs of the society for the first three months.

The Mimico Natural Gas Company (Ltd.)—Will apply for incorporation under Ontario laws to sink, bore, operate, etc., artesian wells, and to produce petroleum, natural gas, and other mineral and volatile substances; and to erect the necessary plant. Operations to be carried on in the County of York. Head office, Toronto. Capital Stock, $100,000 in 1,000 shares of $100 each. Applicants, A. Nelson, J. Currie, W. Parsons, M. Rountree, L. G. Harris, J. Wright, J. Barret, F. Que, W. J. H. Emory, A. Keith, E. J. Clark, all of Toronto; all of whom are to be the first directors.

Sydney Land and Improvement Company (Ltd.)—Application will be made to the British Columbia Legislature for the incorporation of the above company to acquire, lease, sell, and in any way deal in lands, buildings, fore-shore rights, etc., in the British Colonies; to develop and turn to account the same in any manner; to construct, equip, maintain, develop, control, etc., wharves, docks, water-works, gas-works, hotels, clubs, etc.; to carry on the business of builders and contractors, decorators, dealers in stone, sand, lime, bricks, timber, hardware, tile and terra cotta makers, etc., and forwarders, etc., with other powers. Head office, Victoria, B.C. Capital stock, $100,000, in 400 shares of $250 each. Applicants, J. Brethour, T. Norquay, R. Irving, J. White, W. C. Haywood, A. L. Belyea, Victoria, B.C., all of whom except the last are to be the first directors.

The Toronto Granite Company.—This company will apply for incorporation under the Ontario Act to manufacture and sell granite and marble. Head office, Toronto. Capital stock, $45,000 in 900 shares of $50 each. Applicants, A. W. Anderson, N. F. Anderson, Toronto; E. Van Zant, Flesherton, Grey Co.; A. Anderson, H. Anderson, Buffalo, N.Y. The first three to be the first directors.

The Western Canadian Ranching Company, Ltd. (English).—This company has been registered to do business in British Columbia. The objects for which the company is established are to purchase and acquire landed property or any interest therein in Canada or elsewhere, and in particular certain estates situate in British Columbia, briefly known as "Harpers' Ranches," together with the buildings, stock and mining rights appertaining thereto; to purchase, or in any wise deal in any lands, mines, minerals, vessels, etc.; to carry on among other businesses, that of miners, metallurgists, smelters, quarry-owners, brick-makers, etc.; to search for, prospect, and mine any sort of minerals, etc., together with numerous other powers incident to the business of the company. Head office in Canada, Victoria, B.C. Capital stock, £100,000 in 100 Founders' shares of £10 each, and 9,900 ordinary shares of £10 each.

The Guelich Silica Barytic Stone Company.—This company will apply for incorporation under Ontario laws to manufacture artificial stone for street paving, sidewalks, floors, building stone, decorating, etc. Head office, Ingersoll. Capital stock, $100,000 in 1,000 shares of $100 each. Applicants, O. E. C. Guelich, Detroit; C. E. Guelich, J. Podmore, J. A. Richardson, S. Noxon, all of Ingersoll; all of whom are to be the first directors.

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Latest Stock Quotations of Canadian Companies in England.

	Price.	
Excelsior Copper, Limited, £410,738 fully-paid shares of £1	—	
Nicola, Limited, £35,000 fully-paid shares of £1	—	
Shuniah Weachu, Limited, £99,888 fully-paid shares of £1	—	
Silver Wolverine, Limited, £68,465 fully-paid shares of £1	—	
Tilt Cove Copper, Limited, £160,000 fully-paid shares of £2	—	
Ditto, £80,000 5½ per cent. debentures	—	
General Mining, Limited, £219,752 fully-paid shares of £8	3¼	3¾
Low Point, Barrasois and Lingan, £509,100 fully-paid shares of £100	—	
New Vancouver Coal Mining and Land, Limited, £185,000 fully-paid shares of £1	⅝	⅞
North-Western Coal and Navigation, Limited, £160,500 6 per cent. debenture coupons, June 30 and December 31; principal 1904	—	
Ditto, £149,500 fully-paid ordinary shares of £10	—	
Ditto, £900 fully-paid deferred shares of £100	—	
Sydney and Louisburg Coal and Railway, Limited, £50,000 cumulative 10 per cent. first preference shares of £10, £6 paid	7½	8½
Ditto, £14,560 fully-paid non-cumulative 6 per cent. second preference of £10	3	5
Ditto, £250,000 fully-paid ordinary shares of £10	¼	¾
Anglo-Canadian Asbestos, Limited, £11,500 fully-paid shares of £1	—	
Anglo-Canadian Phosphate, Limited, £46,510 fully-paid preference shares of £10	—	
Ditto, £25,000 fully-paid deferred shares of £10	—	
White's Asbestos, Limited, £20,000 fully-paid shares of £1	—	
Ditto, £15,000 shares of £1, with 15s. paid	—	
Bell's Asbestos, Limited. £140,000 fully-paid shares of £5	8⅜	8⅝
Ditto, £68,400 debentures, 5 per cent.; interest January 1 and July 1	—	
Canadian Phosphate, Limited, £100,000 fully-paid shares of £1	—	
General Phosphate, Limited, 5 per cent. ordinary shares of £10, £2 paid	—	
Ditto, £5,000 fully-paid founders' shares of £10	—	
Western of Canada Oil, Limited, £200,000 fully-paid shares of £100	—	
Ditto, £99,850 fully-paid shares of £50	—	
Western of Canada Oil, Limited, £199,700 12 per cent. debentures of £100	—	

Excelsior Copper.—Registered September 26, 1888. Accounts to December 31 submitted in April. No dividend yet. Liquidation and reconstruction have been decided upon.

Nicola.—Accounts to December 30 submitted in November. No dividend yet.

Shuniah Weachu.—Accounts to November 20 submitted in February. No dividend yet. Shares for £12,870 held by the Company.

Silver Wolverine.—Registered October 19, 1888. No report of meeting received yet.

Tilt Cove.—In March, 1890, the properties were leased for 99 years to the Cape Copper Company, Limited, at a rent of £4,400. The Cape Copper Company advance £15,000 at 5 per cent. interest, and when this is repaid out of profits; surplus profits are to be divided equally between the Cape Copper Company and the Tilt Cove Company. The lease may be determined by the Cape Copper Company at any time on twelve months' notice. Accounts annually to March 31 submitted in November.

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Phosphate Shipments.

The following are the official returns of the quantities of Canadian phosphates shipped to Europe from the port of Montreal from June 23 to date:—

Date	Name of Ship.	Destination.	Shippers.	Tons.
Jne 26	SS. Federation.	London.	Lomer Rohr & Co.	400
July 4	" Esther Roy.	Liverpool.	Millar & Co.	250
7	" Oregon.	do	Lomer Rohr & Co.	100
8	" Norse King.	London.	do	100
9	" Warwick.	Glasgow.	do	150
10	" Cremon.	Hamburg.	do	200
10	do	do	Millar & Co.	100
18	" Canopus.	Liverpool.	Wilson & Green.	560
20	" Feliciana.	do	Lomer Rohr & Co.	150
21	" Alcides.	Glasgow.	Anglo-Can. P. Co.	240
				2250

SHIPPERS' RECAPITULATION.

	Tons.
Lomer Rohr & Co.	1100
Wilson & Green	500
Millar & Co.	350
Anglo-Canadian Phosphate Co.	240
Total shipments to date	2250

RECAPITULATION OF EXPORTS.

	Tons.
Liverpool	1060
London	500
Glasgow	390
Hamburg	300
Total tons exported	2250

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Meeting of the Gold Miners' Association of Nova Scotia at Waverley.

The usual order of the regular monthly meeting of the Gold Miners' Association of Nova Scotia, was pleasantly varied this month in being held at Waverley instead of, as customary, at the Halifax Hotel. The day being the "Glorious Fourth," the trip was more in the nature of an excursion than a business meeting, and the Americans of the party in particular, amply observed the festive nature of the day. At 10 a.m. a four-horse team left Dartmouth for Waverley, in which were Messrs. J. M. Reid, of the Oxford gold mines, president of the association; T. R. Gue, president of the Acadia Powder company; John H. Anderson, of the Anderson gold mine; Councillor J. H. Austen of Dartmouth; E. R. Faribault, of Quebec, in charge of the geological surveying party now in Nova Scotia; E. L. Jennings, of Boston; A. E. Bradley, of Boston; C. E. Willis, and representatives of the Press. The drive was a very pleasant one, and the party had no little fun on their way out.

Arrived at Waverley, they were met by Mr. B. C. Wilson, ex-president of the Association, and Mr. G. MacDuff, manager of the deWolfe property, and after the usual introductions, etc., the party adjourned to Laidlaw's Hill, where a large tent had been put up in charge of a staff of waiters, the caterers being the Halifax Hotel. A large contingent arrived by train at Windsor Junction, among whom were Messrs. John E. Hardman, of Lowell, Mass., who is interested in mines in Oldham and West Waverley; Fred. Taylor, also of Lowell, who is associated with Mr. Hardman; Duncan McDonald, of the Truro Foundry company, and Dean S. Turnbull, an American, formerly of the Black Hill mines, but who is now one of the Beaver Dam Mining Company. An informal discussion of mining matters was held for a short time and was then abandoned for a series of impromptu games until 1.30 p.m., when with appetites whetted by exercise, twenty-five members and their friends sat down to a capital lunch. Mr. J. M. Reid, president of the Association took the head of the tables. The toast list was a lengthy one, including Her Majesty the Queen, the President of the United States, Mr. Wilson's health, the guests, the married men, the bachelors, the Press, the host and several others. All were ably responded to, some of the speeches being remarkably good; every one made one or more speeches, and Mr. Jennings rendered a couple of songs in excellent style. After lunch the remainder of the day was spent in visiting the adjacent mines and discussing mining matters. Already much good has come from these meetings, mining being carried on in a much more economical and scientific manner than formerly, and as was remarked by Mr. Wilson in the course of his speech at lunch, they use now a 10 horse power engine and one man to do work for which formerly one hundred men were employed. In the early evening the meeting broke up, very much pleased with their day's outing.

MACHINERY MECHANICS & INVENTIONS

Improved Bosh Plate for Blast Furnaces.

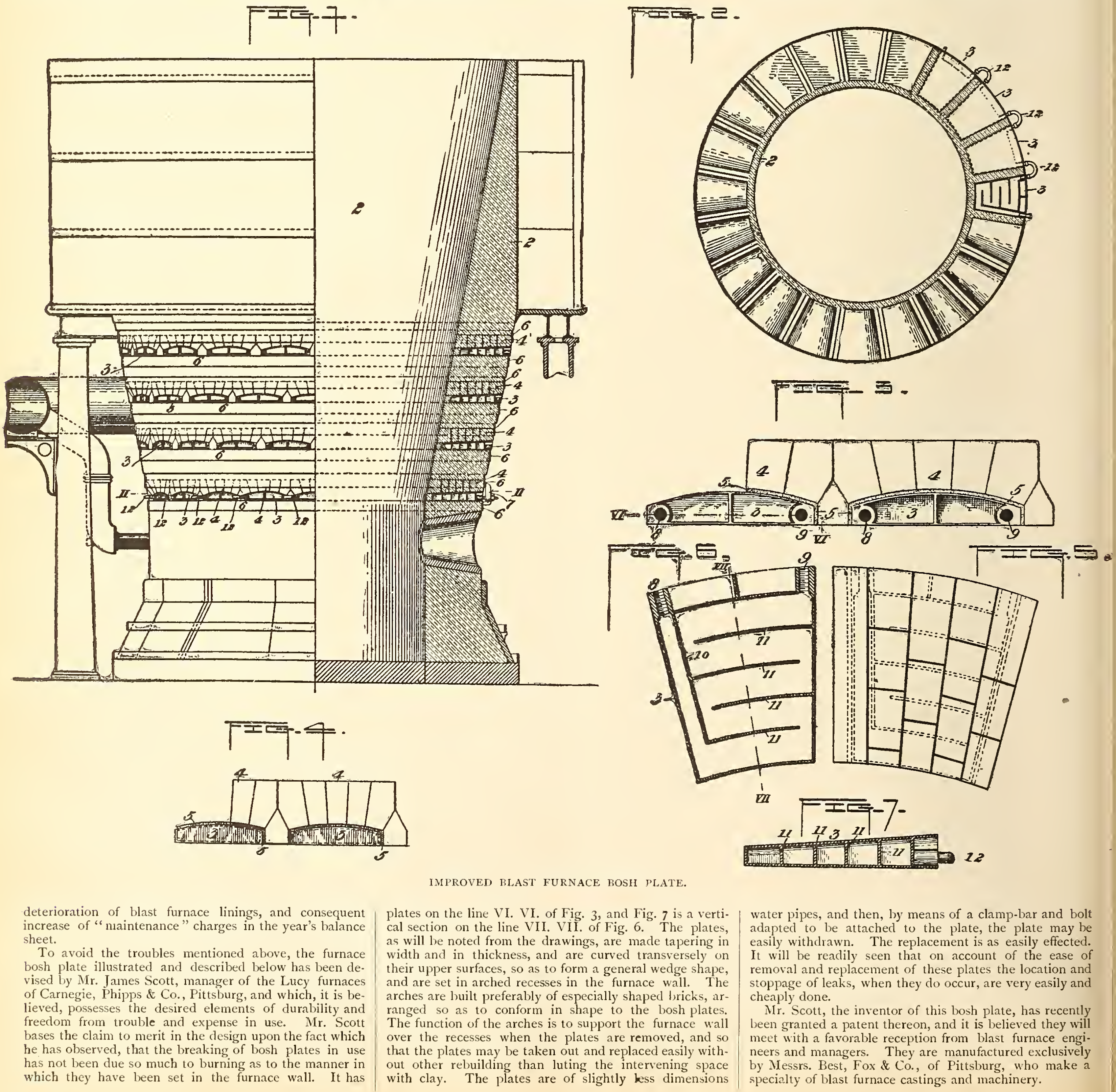
The trouble experienced in the operation of blast furnaces from broken and leaking bosh plates is too well known to furnace managers to need special comment here, more than it has been generally supposed to be, mainly, if not entirely, due to burning out from the intense heat of the bosh. The difficulty of removing a bosh plate when it has been known to have become defective, to say nothing of the difficulty of *locating* the particular one at fault, may likewise be passed without detailed notice. One thing is certain, that the fault and the circumstances under which a furnace has to be run during its correction are the most potent factors in the deterioration of blast furnace linings, and consequent increase of "maintenance" charges in the year's balance sheet.

To avoid the troubles mentioned above, the furnace bosh plate illustrated and described below has been devised by Mr. James Scott, manager of the Lucy furnaces of Carnegie, Phipps & Co., Pittsburg, and which, it is believed, possesses the desired elements of durability and freedom from trouble and expense in use. Mr. Scott bases the claim to merit in the design upon the fact which he has observed, that the breaking of bosh plates in use has not been due so much to burning as to the manner in which they have been set in the furnace wall. It has been the practice to build them directly in the wall, with the bricks bearing on them from above and at the sides and at the intermediate spaces, so that when the brickwork expands and moves by reason of the heat of the furnace it strains the bosh plates and breaks them, even when they themselves have not been injured by the heat.

Referring to the drawings, Fig. 1 is a side elevation, partly in vertical section, showing the bosh of a furnace with plates of the improved form; Fig. 2 is a sectional plan view on the line II. II. of Fig. 1; Fig. 3 is an elevation of two of the bosh plates set in position in the blast furnace wall; Fig. 4, an elevation of the inner end of the bosh plates; Fig. 5 is a plan view of one of the bosh plate arches; Fig. 6, a horizontal section of one of the bosh plates on the line VI. VI. of Fig. 3, and Fig. 7 is a vertical section on the line VII. VII. of Fig. 6. The plates, as will be noted from the drawings, are made tapering in width and in thickness, and are curved transversely on their upper surfaces, so as to form a general wedge shape, and are set in arched recesses in the furnace wall. The arches are built preferably of especially shaped bricks, arranged so as to conform in shape to the bosh plates. The function of the arches is to support the furnace wall over the recesses when the plates are removed, and so that the plates may be taken out and replaced easily without other rebuilding than luting the intervening space with clay. The plates are of slightly less dimensions than the recesses, and in construction the surrounding space is luted with clay, as shown at 5. The bosh is strengthened by bands, 6, encircling the furnace above and below the bosh plates. The preferred internal construction of these plates is as shown in Figs. 6 and 7. Each consists of a hollow plate having water inlet and outlet openings, 8 and 9, a partition forming a passage leading to the rear of the plate from the opening, 8, and baffle plates, 11, which cause the water to travel in a circuitous course between the back of the plate and the opening, 9, and thus affording a very efficient cooling action on the furnace walls.

The removal of the plate, the ease of which is one of the notable and meritorious features of the invention, is accomplished simply by uncoupling the inlet and outlet water pipes, and then, by means of a clamp-bar and bolt adapted to be attached to the plate, the plate may be easily withdrawn. The replacement is as easily effected. It will be readily seen that on account of the ease of removal and replacement of these plates the location and stoppage of leaks, when they do occur, are very easily and cheaply done.

Mr. Scott, the inventor of this bosh plate, has recently been granted a patent thereon, and it is believed they will meet with a favorable reception from blast furnace engineers and managers. They are manufactured exclusively by Messrs. Best, Fox & Co., of Pittsburg, who make a specialty of blast furnace castings and machinery.



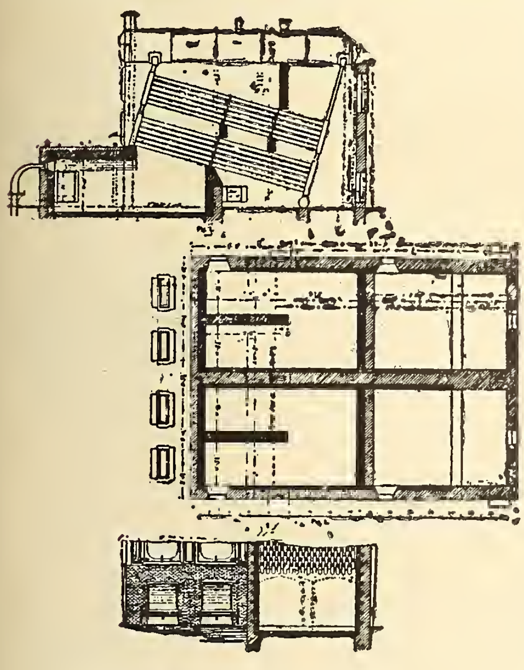
IMPROVED BLAST FURNACE BOSH PLATE.

Gas Burning Device for Blast-Furnace Boilers.

The problem of how to utilize blast-furnace gases to the best advantage under steam boilers has been one that has been only second to the problem of their most advantageous use in the hot-blast stove, but it can hardly be said to have reached so nearly a generally accepted solution as the second named. As an instance of what has proven a remarkably successful practice, we think the following description of a device in use at the Isabella Furnaces at Etna, near New York, will be of interest. While shown as applied to the Babcock & Wilcox, it is equally applicable to other types of boilers, and in fact was, as noted below, used on a different battery of boilers before the present equipment was put in.

The apparatus now used consists essentially of a valve operated on the same principle as the Spearman—being in fact the Spearman valve applied to boiler practice—connected directly with an elbow which differs from that used in introducing gas to the hot-blast stoves in being flattened out so that the mouth of the burner in section is wide and narrow, together with a roomy combustion chamber in front of the boiler setting proper.

Of the drawings, Fig. 1 is a longitudinal vertical section of the setting, showing the valve and combustion chamber; Fig. 2 a plan, and Fig. 3 a portion of the front elevation and vertical cross section through the combustion chamber.



GAS BURNING DEVICE FOR BLAST-FURNACE BOILERS.

As originally applied to the ordinary two-flue boilers at the furnaces there was no combustion chamber, as shown in the drawing, but suitable openings were cut in the boiler fronts and the gas submitted directly under the boilers. Even with this crude application the working of the apparatus was satisfactory, but when the company decided to put in two Babcock & Wilcox boilers, it was decided to have the appointments as favorable as possible. So that all the improvements which had suggested themselves in the first trials were embodied in the new construction.

That which is most important and interesting is just what cannot be shown in a drawing or described in words—that is, the practical working of the burner—how the waste gases from the blast furnace, being introduced into the combustion chamber, become ignited, and forming a hot flame which passes through the tubes and along the whole length of boilers until, when the entrance to the draft stack is reached, the flame seems to have completely spent itself and utilized all its energy. All this can only be appreciated by being seen, but so far as the mechanical construction is concerned it may be described as follows: The Spearman style of valve is built as referred to above, with a wide and narrow mouth, being in section from 30 to 36 inches by 2½ inches. This mouth enters the combustion chamber through an opening about 2½ inches larger all around, the claim being made by the inventor that the gas, going through an opening slightly larger than the mouth of the valve, draws in enough air to assist combustion, and the gas expanding makes a mechanical mixture of the air and gas. By this expansion also the dust carried with the gas is released and deposited at the bottom of the combustion chamber, from which it readily can be removed when it accumulates.

The combustion chamber is designed to be about 4 feet 3½ inches by 8 feet 3 inches. The boilers are fired entirely with blast-furnace gas, a small quantity of coal being thrown into the furnace when the blast is off, so that the gas will ignite when it is turned on again.

This type of burner was adopted by the Monongahela Furnace Company, which had previously burned coal and experienced difficulty in keeping up steam to the required pressure. Since the change, the gases from the furnace are used entirely, and the steam is blowing-off almost continuously.

The Thomson-Houston Lighting Installation at Hammerfest, Norway.

Hammerfest, the most northern city of the world, is the first city in Norway which has introduced the lighting of streets by electricity and which in the near future will light houses by electricity. The station is about one mile from the city; it was built there, as a tremendous water power could be utilized. The turbine plant consists of two radial turbines of different sizes with horizontal water wheel, which make 400 revolutions; the smaller one drives a Thomson-Houston arc dynamo, type H, which is able to feed 18 lamps in series, the current being 6.8 amperes. The larger turbine drives an alternating machine, which carries 650 lights of 16 c.p. On account of the extremely numerous and terrible storms which take place in this latitude, it was necessary to pay the greatest attention to the line. During the last half of the past winter the arc lights burned to the greatest satisfaction, and a native of Hammerfest has taken charge of the plant.

Carbon Brushes for Dynamos and Motors.

The carbon brushes, which Prof. Elihu Thompson has used for some time, offer remarkable advantages, principally when dynamos or motors are submitted to very variable currents and when, consequently, their commutator is liable to wear. In fact when carbon brushes are used, the commutator will be less worn, for the sparks will burn the carbon instead of spoiling the commutator. These advantages are of special importance for railway motors as the use of these carbons allows the change of rotation of the armature without implying the change of the position of the brushes and avoids any abnormal wear of the commutator. A great many of our readers have asked, when carbon brushes were used first in France and we give herewith the information available about this subject.

In France the first experiments were made with charcoal and with carbons in arc lamps. The results of these experiments were the stopping of sparking (of course the carbons had to make a good contact) and a more even wear of the commutators, that is the latter were not furrowed as it is the case when metallic brushes and thick wire brushes were used; moreover the carbon brush wore off only a little. On the other hand, the results showed that the commutators wore out very soon and that the formation of the fine and sticky carbon dust resulted in making them greasy, and the carbon dust, settling in the insulated parts, produced also short circuits, which in more or less time resulted in the spoiling of the commutator. Under these conditions the results were far from being satisfactory; therefore, the carbon brushes, which were made of charcoal plates and of graphite, were abandoned and efforts were made to find a special carbon which would do away with all these inconveniences. The problem to solve was to obtain carbon which would not produce furrows on the commutator, would not wear the latter too quickly and would not cause the settling of the carbon dust in the insulated parts of the commutator, which finally would result in the destruction of the machine. This problem has been solved now and excellent carbon brushes are manufactured. Lacombe & Co., have studied this problem carefully and their carbon brushes are equally as good as those of foreign countries. We had the opportunity to examine lately a commutator of an Edison dynamo which has run now over a year and where Lacombe brushes are used. The commutator is absolutely smooth and looks as if it was polished; the brushes themselves look like polished ebonite at the contact points. This carbon of special composition, is very stable and is extremely soft. The wearing of the brushes is therefore of no account and no trace of carbon dust is found on the machine.

The Colorado Mineral Palace.

(Special correspondence of the Review).

Pueblo was *en fete* on the Fourth, not only because it was "the glorious Fourth," but also on account of the opening of the Colorado Mineral Palace, a building which has been in course of erection for the last two years, and which is described in the local papers in the usual exaggerated style of Western praise as the "eighth wonder of the world." Making due allowance for this ultra superlative description, it must be admitted that the Mineral Palace is something of which Pueblo, and not only Pueblo but the whole of Colorado, may well be proud. It is unique of its kind, for I believe I am right in stating that nothing like it has ever been attempted before.

According to the original plans the Palace was to have been constructed of the lovely native red sandstone, but the immense sum necessary to carry out this plan was too much for even Colorado munificence, and in the end it was built of brick and wood. The architect was Mr. O. Bulow. It is modernized Egyptian in style, painted on the outside in terra cotta with trimmings of olive green, and surrounded on three sides by a wide colonnade, supported by massive pillars. Each of the four corners of the roof rests on an enormous globe. Within the Palace the color is very beautiful, all in soft shades of terra cotta and gold. The building is 243 feet in length and 142 in width, and the domed ceiling is supported by 24 pillars. Around the base of each pillar as well as between the pilasters projecting from the walls, are the mineral exhibits, to give, I suppose, the impression of the whole structure resting upon the mineral wealth of Colorado. There are 24 domes, the largest being 210 feet in circumference, and all have been exquisitely decorated by D. R. Fay, of New York. Each one is different, and all are painted in Colorado wild flowers, than which no more beautiful models could well have been chosen, except the four corner ones, which are done in tropical flowers. It may interest some people and give some idea of the extent of the work to know that the artist received ten dollars an hour for his services. There is a large fixed stage representing the interior of a mine, lined with minerals of every description and hung with glittering stalactites, besides which there are all the usual appurtenances of a western mine visible, burros, jack mules, etc. The effect, when lighted at night, is very good. By the way, the building is well supplied in the matter of light, there being 22,000 electric lights within the walls. The decorations throughout the whole building are in very good taste.

To the right and left of the stage, above and overlooking the main hall, are two good sized art galleries in which the first picture placed was a large Colorado scene from the brush of the well known artist, Mr. Joseph Hitchens, formerly of Montreal.

The mineral display is magnificent, representing every kind of ore, marbles, granites, all kinds of clay and kaolin, galena, coal, etc., and speaking volumes for the mineral wealth of Colorado. One of the most valuable exhibits is a $75,000 collection of native crystallized gold. To the right of the stage is the exhibit from the Pueblo Smelting and Refining Co. It takes the form of a large pipe organ, and is most ingeniously planned to show off the different products of the works. The pipes are lengths of lead pipe made in the establishment, and the panels are made of smaller lead pipes, the white keys of small bars of lead, the black keys of small copper ingots, the pedals of full sized pigs of lead, the half notes being of full sized copper ingots; the stops are of antimonial lead. It may interest Canadian readers to know that this exhibit was designed by Mr. E. P. Matthewson, the superintendent of the smelter, a son of James Adams Matthewson, of Montreal; the lead pipes were made by John MacDonnell, also formerly of Montreal. During the summer a course of lectures by eminent men, among them Talmage, is to be given in the Palace under the management of Mr. Francis A. McKeown, of Toronto.

L. B. Colson.

Pueblo, Colo., July 6th, 1891.

A Remarkable Scandal in German Iron Works.

A law suit is now proceeding at Essen, Germany, against a journalist, Herr Fusangel, who has published long and circumstantial accounts of the manner in which certain alleged frauds were practiced by the Bochum Union, the greatest steel making establishment in Germany. This trial has now taken a startling turn. Mr. Wm. Baare, the director general of the Bochum Union, and one of the greatest industrial princes of Germany, holding the highest official and honorary positions, has, in conjunction with others connected with these steel works, been accused of having for many years systematically and purposely defrauded the national, as well as the municipal revenues by manipulating their income tax estimates in such a way as to avoid paying taxes on almost nine-tenths of their incomes. Nine out of ten, after thorough cross examination, confessed having never paid by half or even as much as one-tenth the income tax they should have paid, and so proved the justice of the accusations, but Mr. Wm. Baare refused to acknowledge his guilt, and challenged his accusers to produce proofs. His accusers were not slow to accept the challenge, and brought forward new accusations of the most startling nature; moreover, of such a character that, if true, they will become of almost international importance. The Bochum Steel Works supply most German and a vast number of foreign and colonial railway administrations and companies with steel rails, sleepers, axles, etc., steel requisites for railways and railway carriages, and have always been looked upon as A 1 in every respect. But now the director general and the board of directors of these great works are accused of having systematically and purposely practiced, at all events connived at the practice of the most audacious frauds possible for manufacturers and contractors. The accuser says "that during the last 16 years the Bochum Steel Works have systematically practiced stamping forgeries of the worst kind, on German, foreign and colonial railway administrations and companies; that such stamping forgeries were carried out in such a way that the official stamps of the government or railway inspectors and comptrollers were systematically imitated, and that after the inspection, those rails, etc., which had been rejected, were stamped with the forged stamp, which had during the inspection and examination been prepared by an engraver, specially retained by the Bochum Steel Works for this purpose." The accuser further says "that the Bochum Steel Works in order to be able to get rid of their inferior steel manufactures, practiced another fraud, namely, substituted for the rails, axles, etc., which had been chosen by the official examiner for being tested for their tensile strength, similar rails, axles, etc., which they had specially made from the very finest 'testing' steel that could be manufactured. The officially stamped rails, axles, etc., were surreptitiously removed, viz., replaced by rails, axles, etc., of much superior material, which had meanwhile been stamped with the fraudulent stamps of the Bochum Works." The tests were made, and invariably proved highly satisfactory. The accuser produced at once in substantiation of his accusation, a quantity of stamps, of which in all some 57 were in use during the last 16 years; moreover, he produced orders to and receipts from the maker of such stamps; he also gave a number of railway accidents, etc., which he alleges have been caused by breakdowns in consequence of the fraudulent practices of the Bochum Union. The public prosecutor at once stepped in and entered a separate action for wholesale commercial forgeries and defraudations alleged against Mr. Baare, his co-directors, and the Bochum Union.

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J. W. BRAKENRIDGE, B.C.L.,
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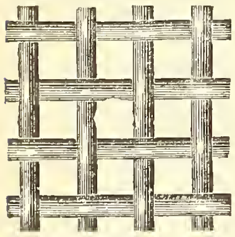

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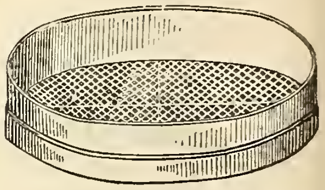

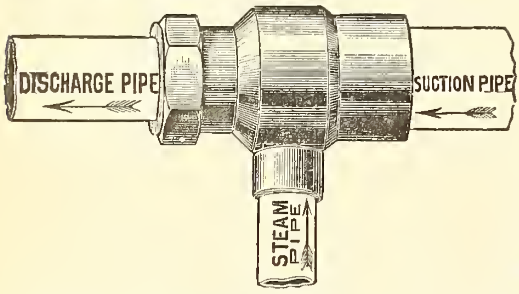

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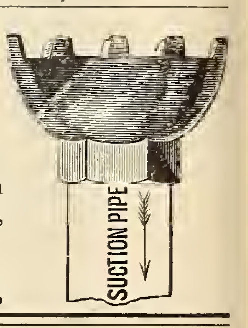

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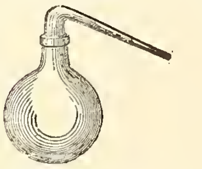

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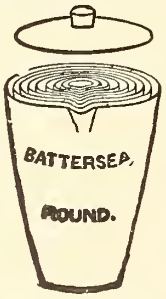

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Members of the force are supplied with free rations, a free kit on joining, and periodical issues during the term of service.

Applicants may be engaged at the Immigration office, Winnipeg, Manitoba; or at the Headquarters of the Force Regina N. W. T.

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MONEY ORDERS may be obtained at any Money Order Office in Canada, payable in the Dominion and Newfoundland; also in the United States, the United Kingdom, France, Germany, Austria, Hungary, Italy, Belgium, Switzerland, Portugal, Sweden, Norway, Denmark, the Netherlands, India, Japan, the Australian Colonies, and other Countries and British Colonies generally.

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These lands are held in absolute fee simple under Crown Patents. In addition to phosphate they contain many other minerals, among which may be mentioned ASBESTOS, MICA and BARYTES. As will be observed, most of the lots are in fairly close proximity, and they adjoin, or are actually traversed by a good county road, affording easy transit to the East Templeton Railway Station and Wharves on the Ottawa River. After personal examination Sir William Dawson, LL.D., F.R.S., F.G.S., the eminent Geologist, reported regarding this property: "In my opinion it has been very judiciously selected both with reference to probable yield of phosphate and facility of transport."

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It is intended to collect in the rooms of the Association specimens of all merchantable Canadian Minerals, with particulars as to place of deposit, and other information which may be useful both from a scientific and merchantable point of view. With this object the Association has decided to open rooms in Toronto within the next few weeks, where information can be sent and obtained, of Mining Properties for sale, and the undersigned has been appointed Managing Director.

The Stock Books of the Association are now open, and mining men and parties having mining properties to dispose of in all parts of the Province are invited to become members of the Association and to send information regarding their properties.

A person can become a member by subscribing for one share of $10 and by paying an annual membership fee of $4.

Further particulars can be obtained by applying to the undersigned,

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LICENSES TO SEARCH, good for one year, $20 for 5 square miles. Lands applied for must not be more than 2½ miles long, and the tract so selected may be surveyed on the Surveyor General's order at expense of Licensee, if exact bounds cannot be established on maps in Crown Land Office. Renewals for second year may be made by consent of Surveyor General, on payment of $20.

Second Rights to Search can be given over same ground, subject to party holding first Rights, on payment of $20.

LEASES.—On payment of $50 for one square mile, good for two years, and extended to three years by further payment of $25. The lands selected must be surveyed and returned to Crown Land Office. Leases are given for 20 years, and renewable to 80 years. The Surveyor General, if special circumstances warrant, may grant a Lease larger than one square mile, but not larger than two square miles.

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Coal, 10 cts. per ton of 2,240 lbs.
Copper, 4 cts. on every 1 per cent. in a ton of 2,352 lbs.
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APPLICATIONS can be fyled at the Crown Land Office each day from 9.30 a.m. to 4.30 p.m., except Saturday, when Office closes at 1 p.m.

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MINING REGULATIONS

TO GOVERN THE DISPOSAL OF DOMINION LANDS CONTAINING MINERALS, OTHER THAN COAL, 1890.

THESE REGULATIONS shall be applicable to all Dominion Lands containing gold, silver cinnabar, lead, tin, copper, petroleum, iron or other mineral deposits of economic value, with the exception of coal.

Any person may explore vacant Dominion Lands not appropriated or reserved by Government for other purposes, and may search therein either by surface or subterranean prospecting for mineral deposits, with a view to obtaining under the Regulations a mining location for the same but no mining location or mining claim shall be granted until the discovery of the vein, lode or deposit of mineral or metal within the limits of the location or claim.

QUARTZ MINING.

A location for mining, except for iron or petroleum, on veins, lodes or ledges of quartz or other rock in place, shall not exceed 1,500 ft. in length and 500 ft. in breadth. Its surface boundary shall be four straight lines, the opposite sides of which shall be parallel, except where prior locations would prevent, in which case it may be of such a shape as may be approved of by the Superintendent of Mining.

Any person having discovered a mineral deposit may obtain a mining location therefor, in the manner set forth in the Regulations which provides for the character of the survey and the marks necessary to designate the location on the ground.

When the location has been marked conformably to the requirements of the Regulations, the claimant shall within sixty days thereafter, file with the local agent in the Dominion Land Office for the district in which the location is situated, a declaration or oath setting forth the circumstances of his discovery, and describing, as nearly as may be, the locality and dimensions of the claim marked out by him as aforesaid; and shall, along with such declaration, pay to the said agent an entry fee of FIVE DOLLARS. The agent's receipt for such fee will be the the claimant's authority to enter into possession of the location applied for.

At any time before the expiration of FIVE years from the date of his obtaining the agent's receipt it shall be open to the claimant to purchase the location on filing with the local agent proof that he has expended not less than FIVE HUNDRED DOLLARS in actual mining operations on the same; but the claimant is required, before the expiration of each of the five years, to prove that he has performed not less than ONE HUNDRED DOLLARS' worth of labour during the year in the actual development of his claim, and at the same time obtain a renewal of his location receipt, for which he is required to pay a fee of FIVE DOLLARS.

The price to be paid for a mining location shall be at the rate of FIVE DOLLARS PER ACRE, cash, the sum of FIFTY DOLLARS extra for the survey of the same.

No more than one mining location shall be granted to any individual claimant upon the same lode or vein.

IRON AND PETROLEUM.

The Minister of the Interior may grant a location for the mining of iron or petroleum, not exceeding 160 acres in area which shall be bounded by north and south and east and west lines astronomically, and its breadth shall equal it in length. Provided that should any person making an application purporting to be for the purpose of mining iron or petroleum thus obtain, whether in good faith or fraudulently, possession of a valuable mineral deposit other than iron or petroleum, his right in such deposit shall be restricted to the area prescribed by the Regulations for other minerals, and the rest of the location shall revert to the Crown for such disposition as the Minister may direct.

The regulations also provide for the manner in which stone quarries may be acquired.

PLACER MINING.

The Regulations laid down in respect to quartz mining shall be applicable to placer mining as far as they relate to entries, entry fees, assignments, marking of localities, agents' receipts, and generally where they can be applied.

The nature and size of placer mining claims are provided for in the Regulations, including bar, dry, bench, creek or hill diggings, and the RIGHTS AND DUTIES OF MINERS are fully set forth.

The Regulations apply also to

BED-ROCK FLUMES, DRAINAGE OF MINES AND DITCHES.

The GENERAL PROVISIONS of the Regulations include the interpretation of expressions used therein; how disputes shall be heard and adjudicated upon; under what circumstances miners shall be entitled to absent themselves from their locations or diggings, etc., etc.

THE SCHEDULE OF MINING REGULATIONS

Contains the *forms* to be observed in the drawing up of all documents such as:—"Application and affidavit of discoverer of quartz mine." "Receipt for fee paid by applicant for mining location." "Receipt for fee on extension of time for purchase of a mining location." "Patent of a mining location." "Certificate of the assignment of a mining location." "Application for grant for placer mining and affidavit of applicant." "Grant for placer mining." "Certificate of the assignment of a placer mining claim." "Grant to a bed-rock flume company." "Grant for drainage." "Grant of right to divert water and construct ditches."

Since the publication, in 1884, of the Mining Regulations to govern the disposal of Dominion Mineral Lands the same have been carefully and thoroughly revised with a view to ensure ample protection to the public interests, and at the same time to encourage the prospector and miner in order that the mineral resources may be made valuable by development.

COPIES OF THE REGULATIONS MAY BE OBTAINED UPON APPLICATION TO THE DEPARTMENT OF THE INTERIOR.

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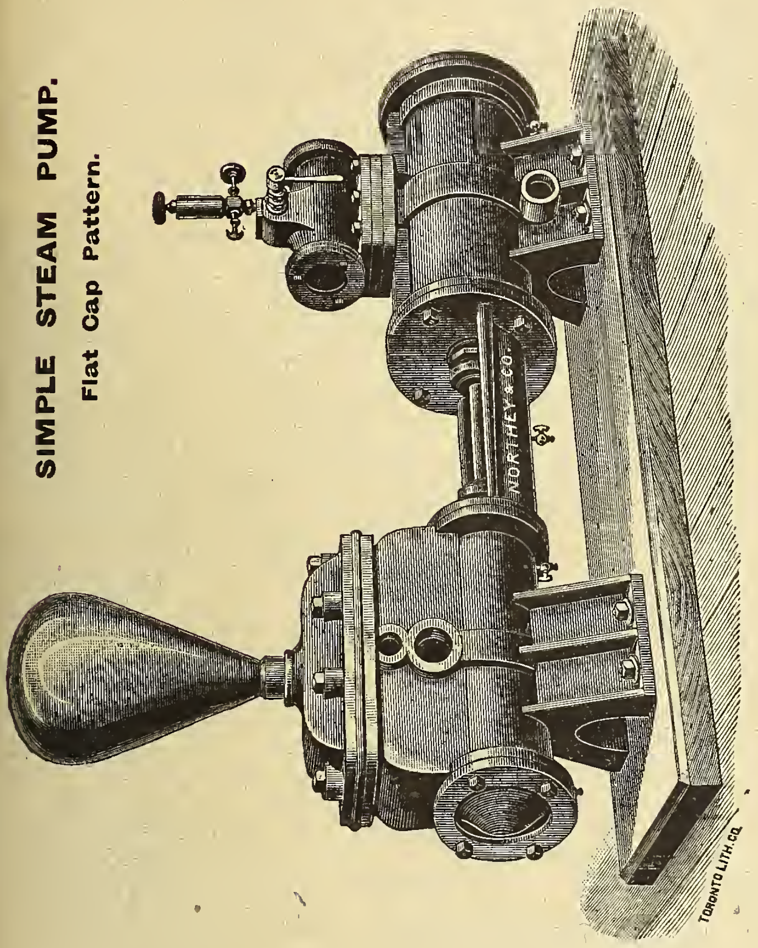
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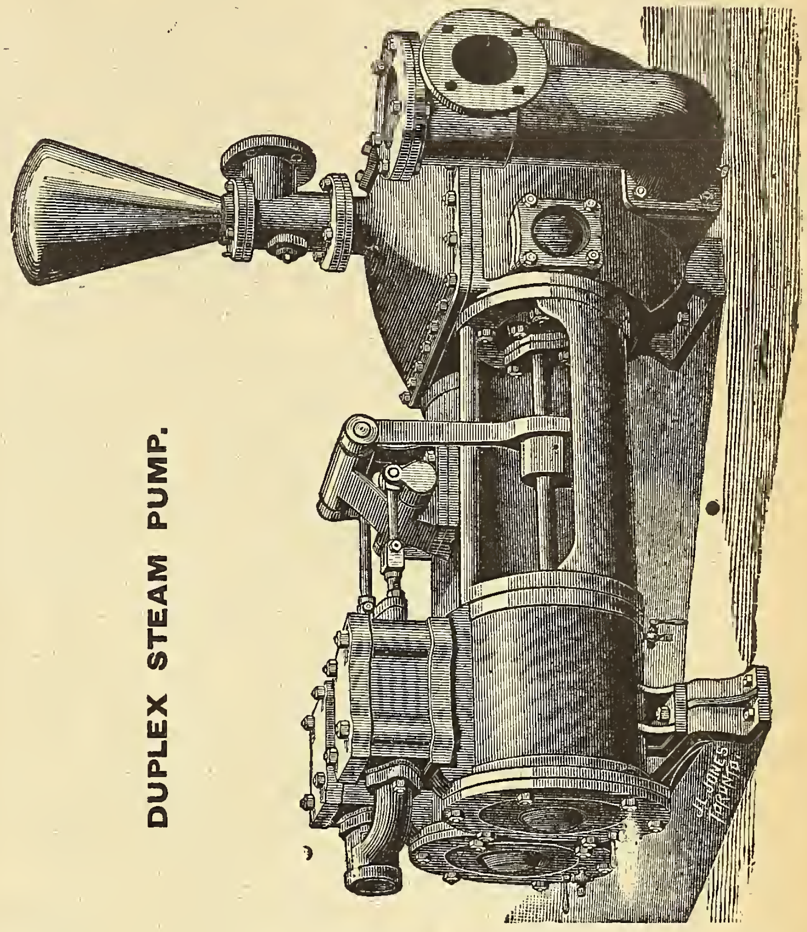

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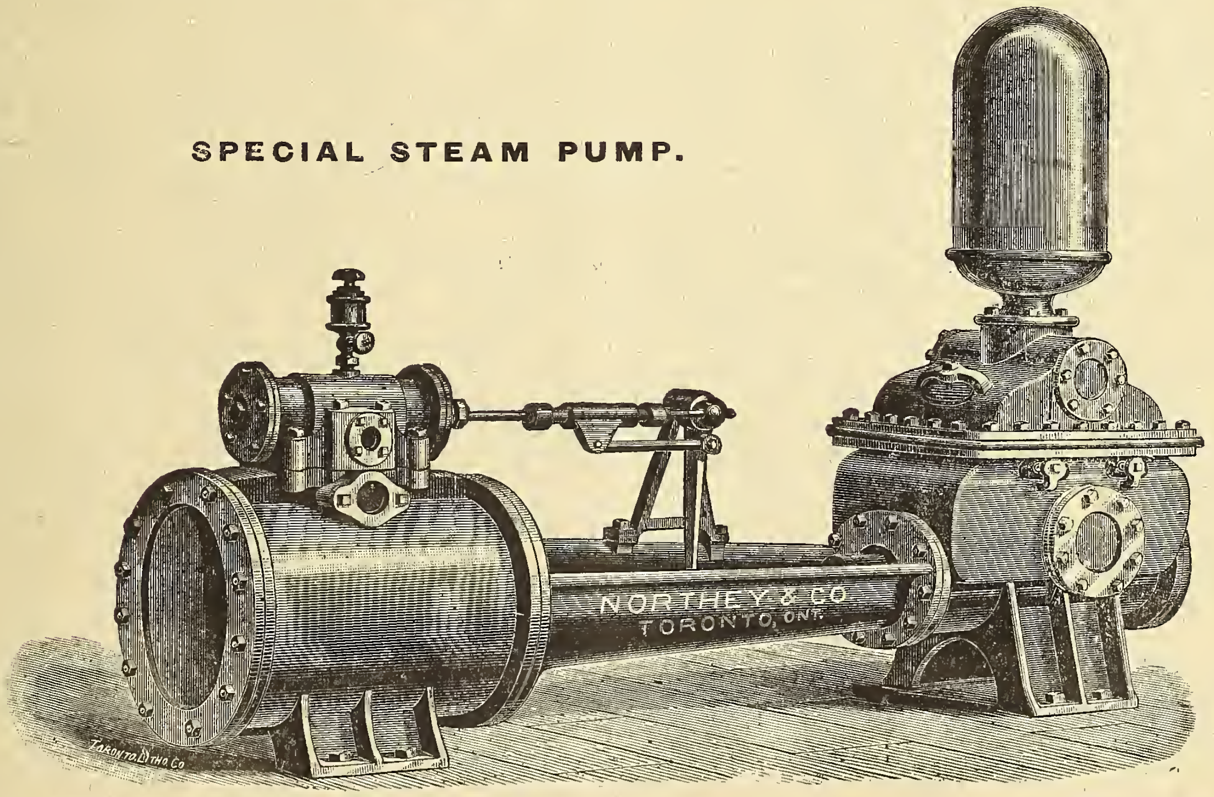

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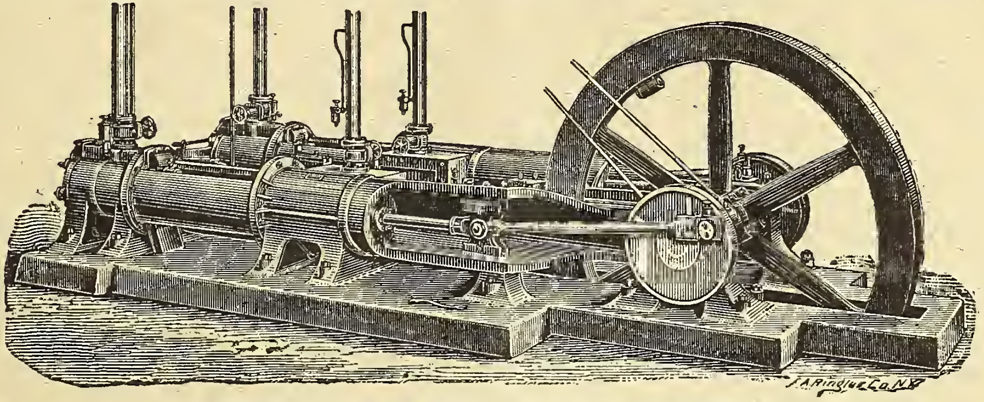
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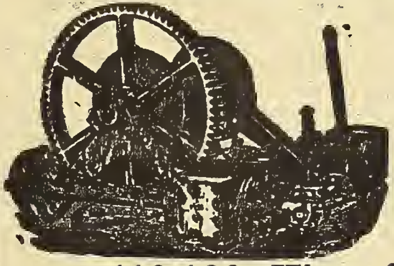

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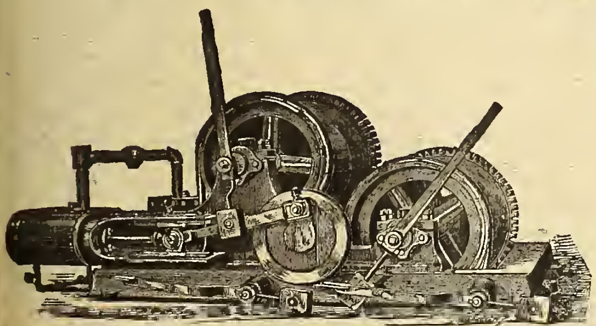

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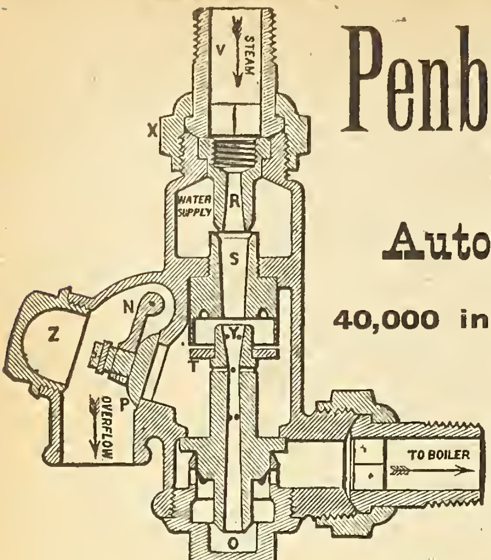

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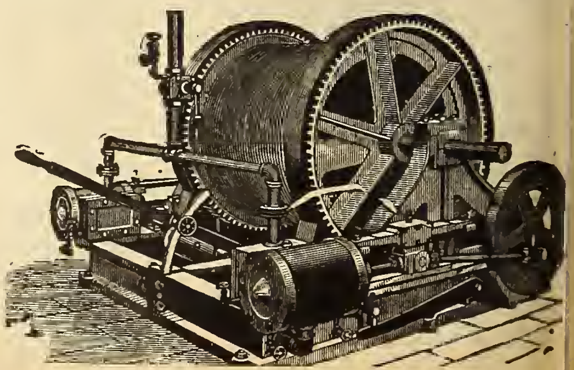

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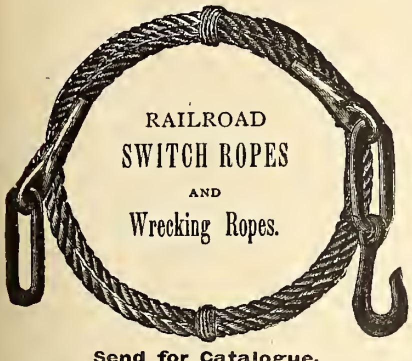

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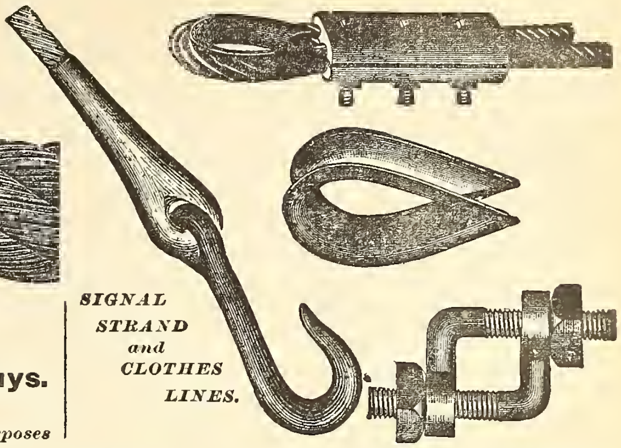

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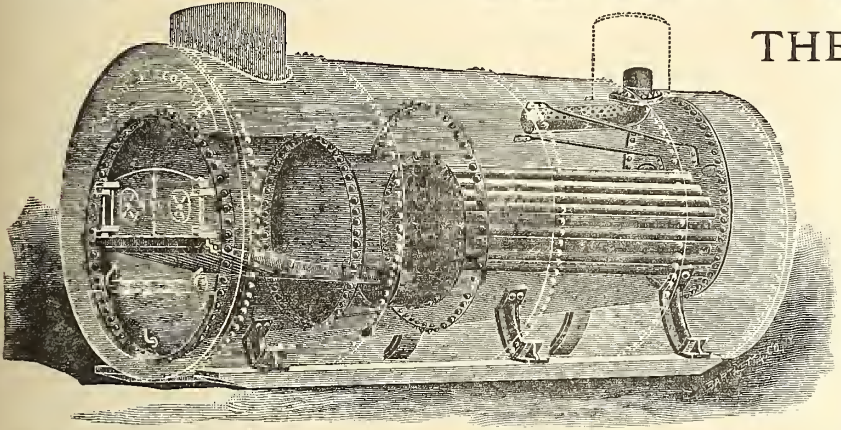

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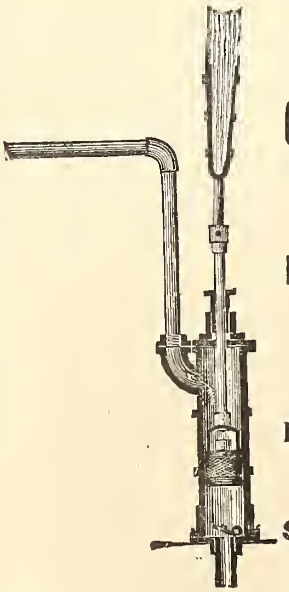

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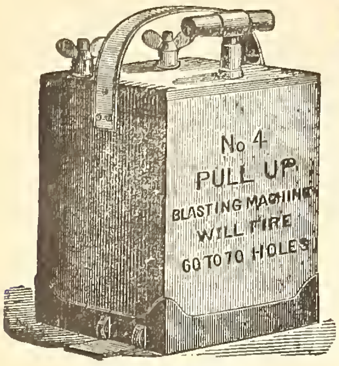

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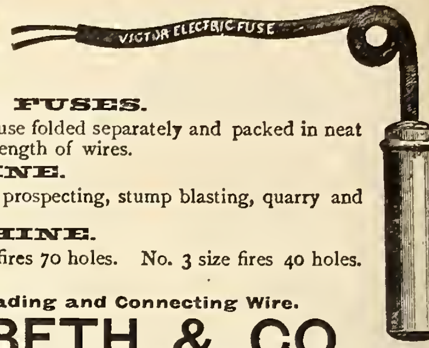

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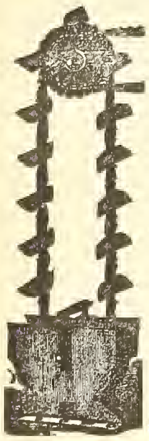

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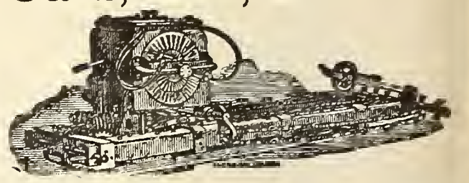

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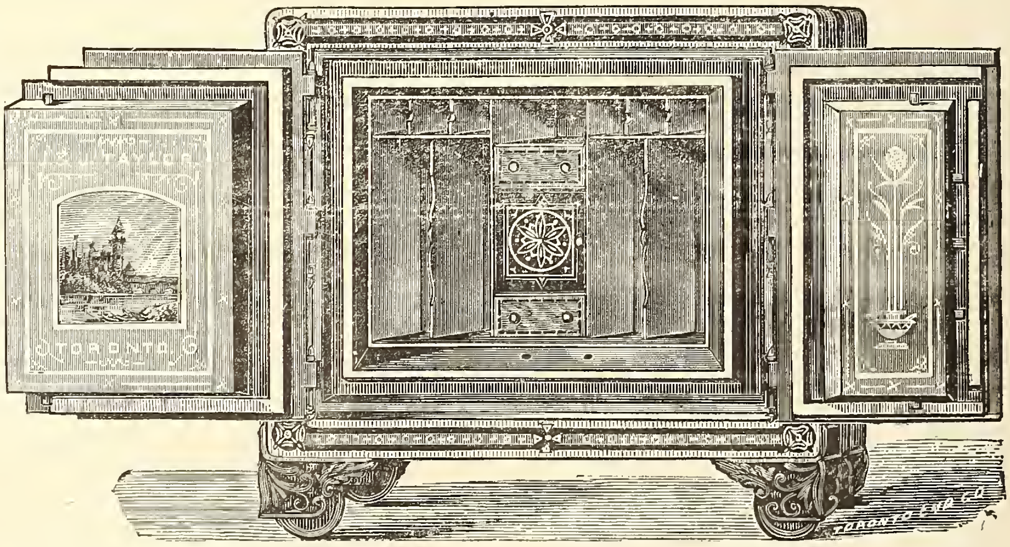

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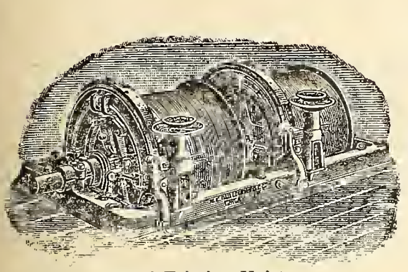

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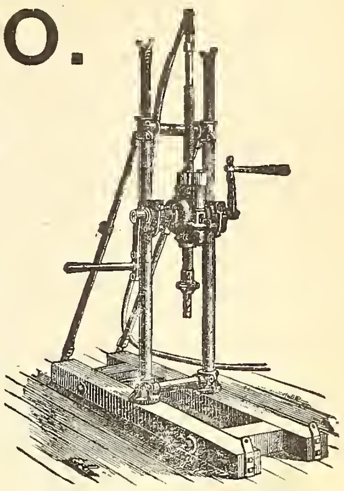

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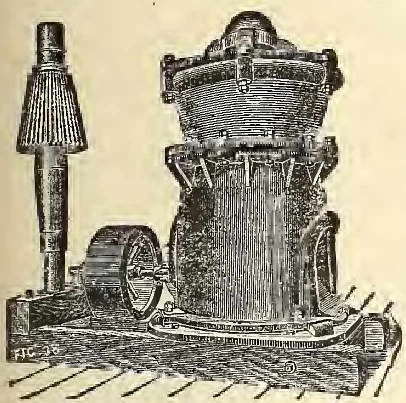

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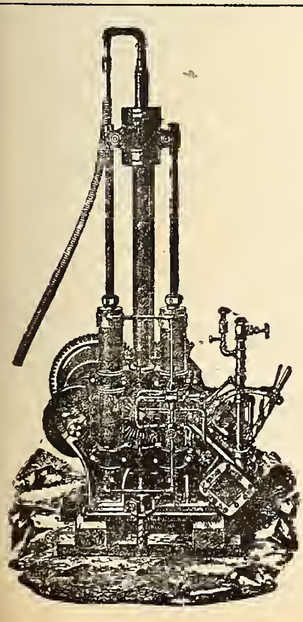

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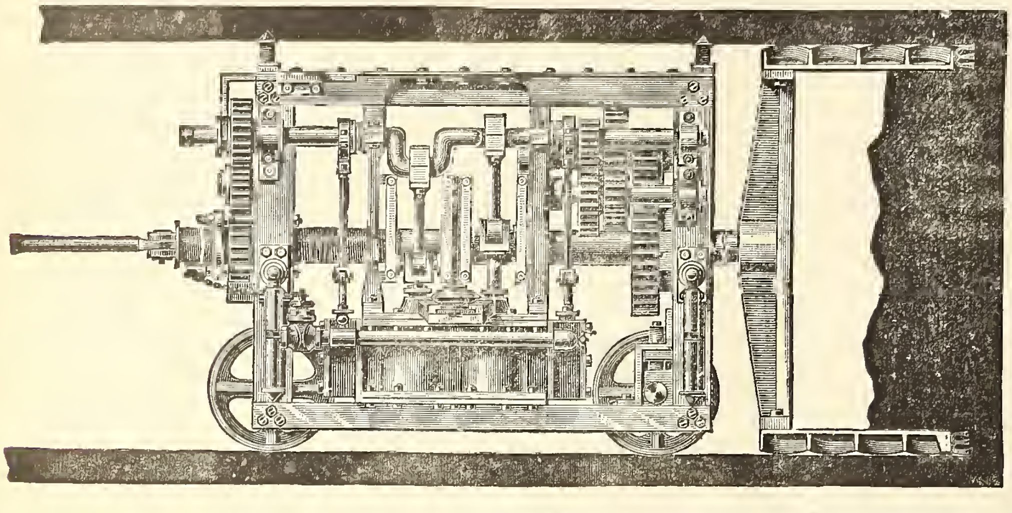

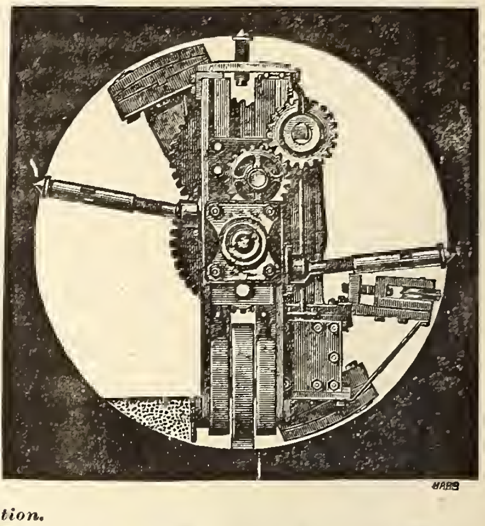

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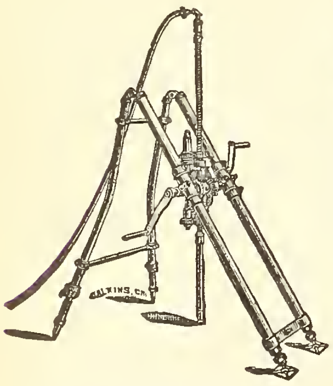

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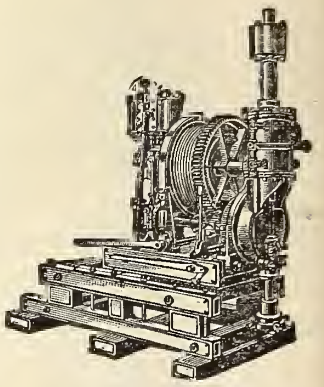

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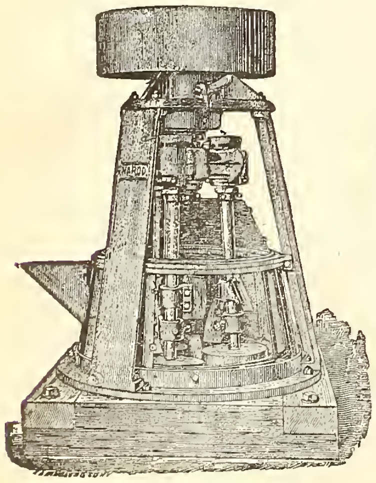

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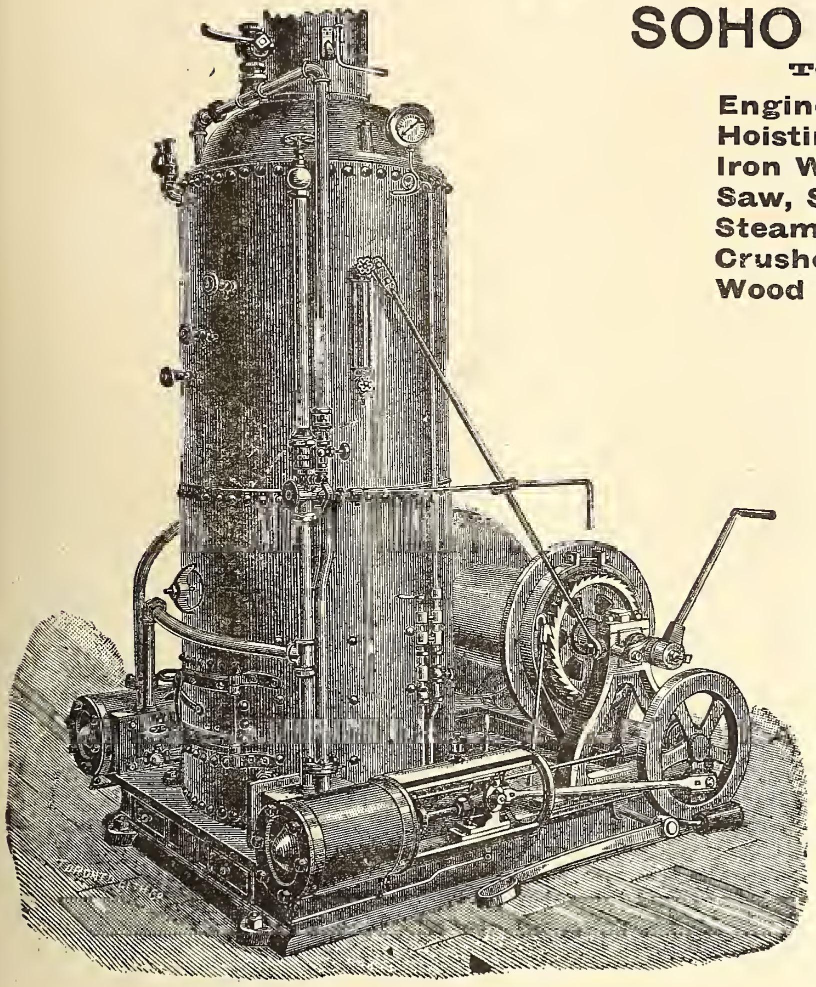

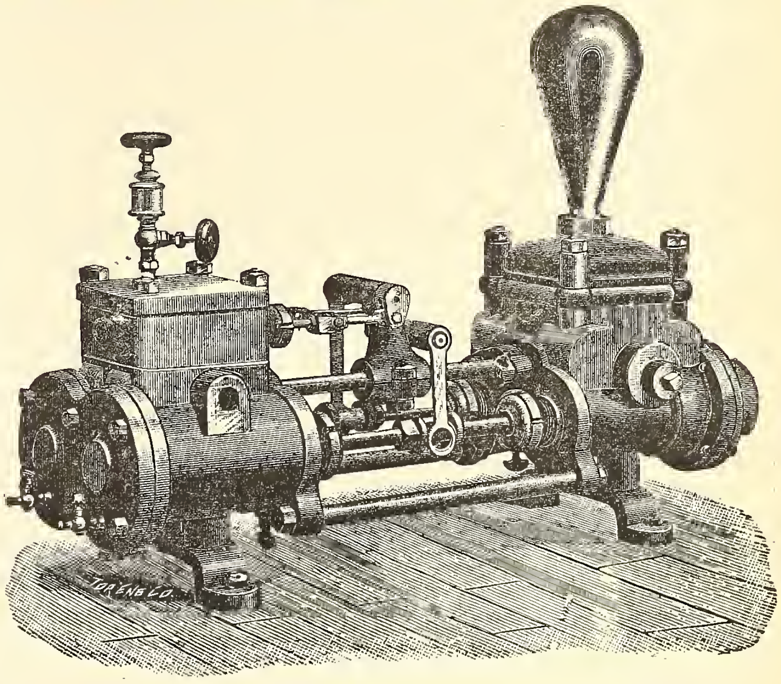

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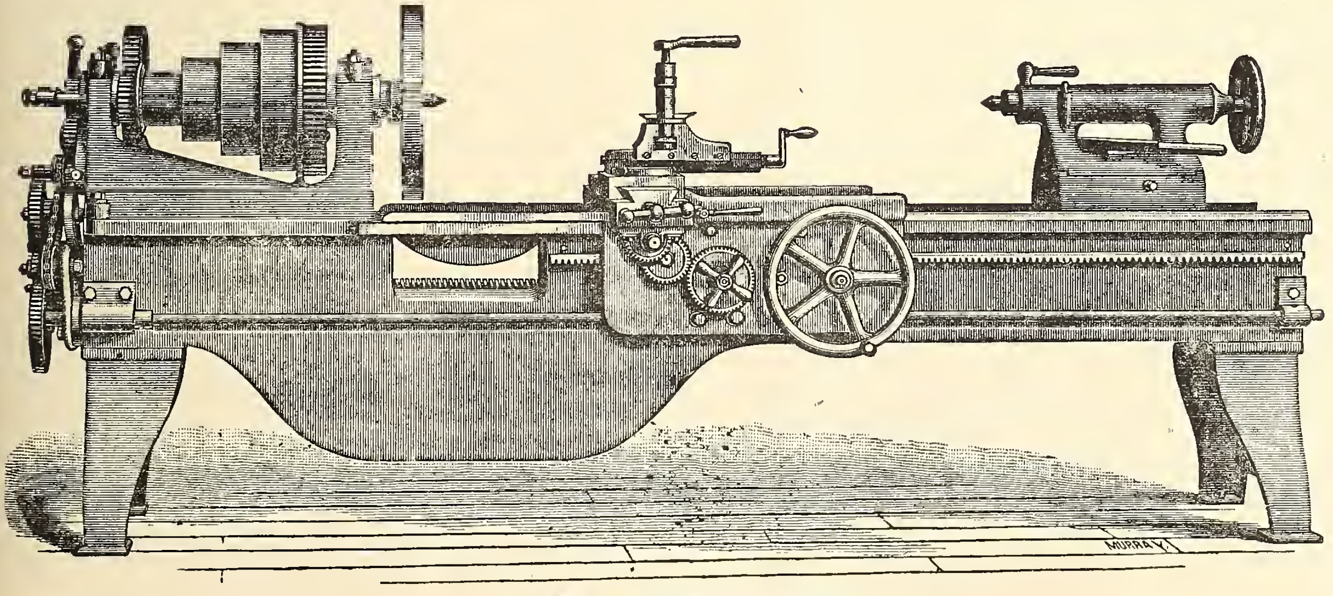

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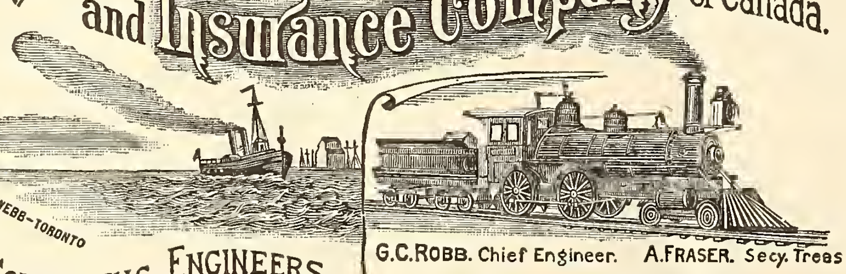

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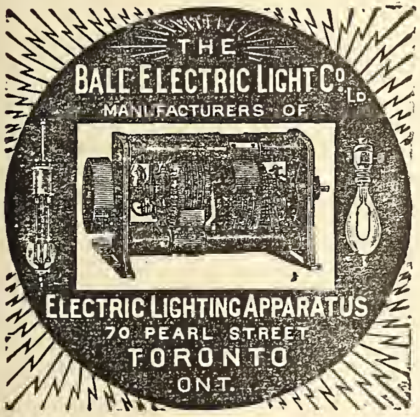

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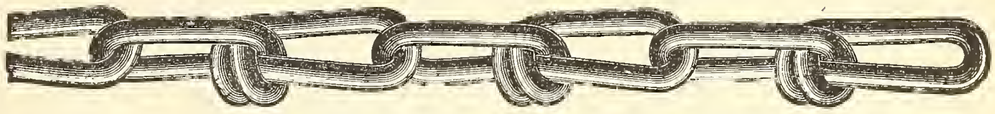

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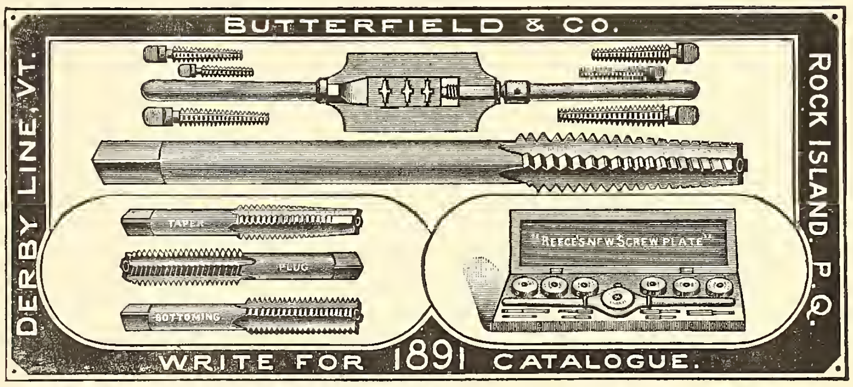

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Licenses are issued to owners of quartz crushing mills who are required to pay Royalty on all the Gold they extract at the rate of two per cent. on smelted Gold valued at $19 an ounce, and in smelted gold valued at $18.00 an ounce.

Applications for Licenses or Leases are receivable at the office of the Commissioner of public Works and Mines each week day from 10 a.m. to 4 p.m., except Saturday, when the hours are from 10 to 1. Licenses are issued in the order of application according to priority. If a person discovers Gold in any part of the Province, he may stake out the boundaries of the areas he desires to obtain, and this gives him one week and twenty-four hours for every 15 miles from Halifax in which to make application at the Department for his ground.

MINES OTHER THAN GOLD AND SILVER.

Licenses to search for eighteen months are issued, at a cost of thirty dollars, for minerals other than Gold and Silver, out of which one square mile can be selected for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

All rentals are refunded if afterwards the areas are worked and pay royalties. All titles, transfers, etc., of minerals are registered by the Mines Department free of charge, and provision is made for lessees and licensees whereby they can acquire promptly either by arrangement with the owner or by arbitration all land required for their mining works.

The Government as a security for the payment of royalties, makes the royalties first lien on the plant and fixtures of the mine.

The unusually generous conditions under which the Government of Nova Scotia grants its minerals have introduced many outside capitalists, who have always stated that the Mining laws of the Province were the best they had had experience of.

The royalties on the remaining minerals are: Copper, four cents on every unit; Lead, two cents upon every unit; Iron, five cents on every ton; Tin and Precious Stones; five per cent.; Coal, 7½ cents on every ton sold.

The Gold district of the Province extends along its entire Atlantic coast, and varies in width from 10 to 40 miles, and embraces an area of over three thousand miles, and is traversed by good roads and accessible at all points by water. Coal is known in the Counties of Cumberland, Colchester, Pictou and Antigonish, and at numerous points in the Island of Cape Breton. The ores of Iron, Copper, etc., are met at numerous points, and are being rapidly secured by miners and investors.

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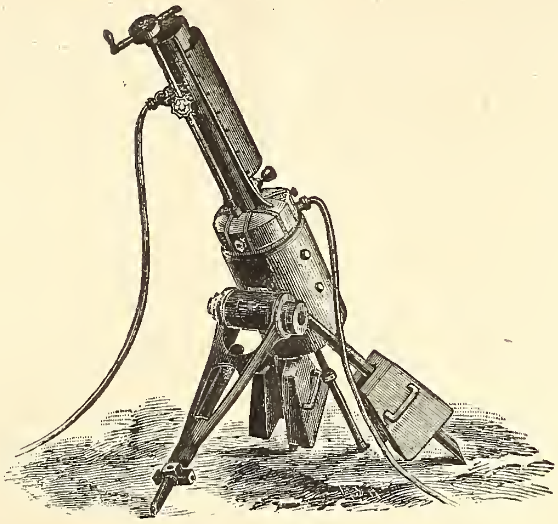

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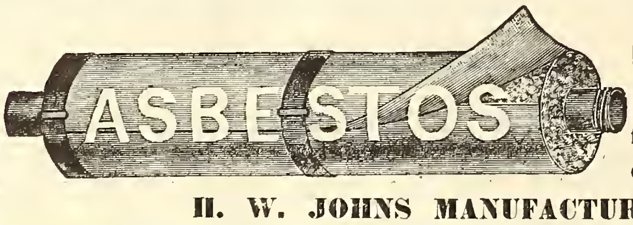

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Ontario Mining Laws.

The following is a summary of the chief provisions of the amendments to the Mining Laws of Ontario, passed during the Session of 1891:

1. In Algoma, Thunder Bay, Rainy River and that part of Nipissing north of Lake Nipissing and the French and Mattawa Rivers, the price per acre of mining lands sold after the 4th day of May, 1891, is $4.50 in a surveyed township, and $4 in an unsurveyed territory, if within 12 miles of a railway, and if beyond that limit $3.50 in surveyed and $3 in unsurveyed territory. Elsewhere the price is $3 in a surveyed township any part of which lies within 12 miles of a railway, and $2 if at a greater distance.

2. Instead of by grant in fee simple, mining land may be obtained under a ten years' lease at a per acre rental, unless otherwise fixed by regulation, of $1 for the first year and 25 cents yearly thereafter if north of Lake Nipissing and the French and Mattawa Rivers, or of 60 cents for the first year and 15 cents yearly thereafter, if situated elsewhere, with right of renewal at the expiration for an additional ten years at the same rentals, and with a right of renewal thereafter every twenty years, subject to payment of the yearly rent charge in advance and to such conditions as may be provided by regulation. But the lessee may at any time purchase the land so held, in which case the first year's rent shall be treated as part of the purchase money.

3. The owner or lessee of mining land sold or leased by the Crown after the 4th day of May, 1891, is required during the first seven years to expend in actual mining operations $4 per acre if the location exceeds 160 acres, and $5 per acre if it is 160 acres or less.

4. After the 4th day of May, 1891, all ores or minerals of silver, nickel, or nickel and copper, taken from lands sold or leased by the Crown, are subject to a royalty of 3 per cent., and all other ores or minerals to such royalties as shall from time to time be fixed by Order-in-Council, not exceeding in the case of iron 2 per cent., and as to any other ores or minerals not exceeding 3 per cent.; and such royalties shall be calculated upon the value of the ores at the pit's mouth. But royalties shall not be imposed or collected upon any ores until after seven years from date of the patent or lease, except as to mines known to be rich in nickel, and as to these not until after four years.

5. Hereafter in all lands sold under the Public Lands Act, or for agricultural purposes, all minerals and mining rights are reserved to the Crown, unless otherwise provided in the patent or grant.

6. In the case of mining lands for which bona fide application was made in writing to the Department prior to the 24th April, 1891, grants may be made where the application is received within three months from the 4th day of May, 1891, and otherwise at the price and upon the conditions heretofore applicable in accordance with the terms of section 1, sub-section 5, of the Act of 1891.

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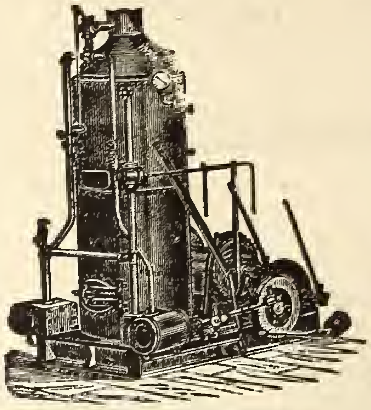

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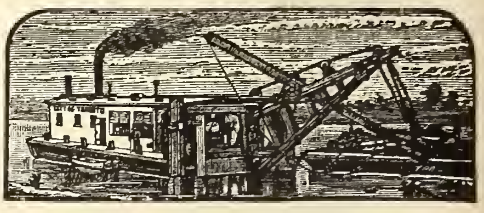

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Vol. X. AUGUST, 1891. No. 8.

The Prospects for a Possible Extension of the Chracoal Iron Industry in Canada.

Since 1887 the Dominion trade reports have not distinguished, as formerly, the importation of charcoal pig, from other pig iron, nor have they shown the importation of scrap separately from pig, nor is the export of charcoal from the Province of Ontario to be found in their pages. The price of the pig imported from the United States figures in the returns at $18 a ton, that from Great Britain at $11.50 a ton. It has been estimated that the yearly charcoal pig importation from the United States is 10,000 tons, and so far the combined influence of the tariff and the bounty does not appear to have diminished our dependence upon the United States or Great Britain for either charcoal or other pig iron. The following figures leave no room for doubt that the demand for pig iron increases in greater ratio than the home manufacture:—

Year ending June 30.	Charcoal Pig. — Tons.	Other Pig & Scrap. — Tons.	Imported from.	Bounty on Home Manufacture.	Tons Home Manu'fre
1884..	1995	9,517	United States.		
	203	65,900	Great Britain.		
1885..	1119	7,389	United States.		
		33,594	Great Britain.		
1886..	3185	6,871	United States.		
		34,180	Great Britain.		
1887.	3919	5,902	United States.		
		38,727	Great Britain.	$59,576	39,717
1888..		12,980	United States.		
		36,440	Great Britain.	33,314	22,209
1889..		13,682	United States.		
		60,162	Great Britain.	37,233	24,822
1890..		23,443	United States.		
		62,697	Great Britain.	25,697	25,697

The bounty from 1st July, 1883, to 30th June, 1889, was $1.50 a ton on all pig iron made in Canada from Canadian ore, from 1st July, 1889, to 30th June, 1892, the bounty is fixed at $1 a ton, and from 1st July, 1892, to 30th June, 1897, at $2 a ton. No doubt the bounty is computed on the short ton which makes it considerably more on the basis of the long ton, by which the iron is sold for consumption. The importations of cast iron pipe amount to 4,000 tons yearly; and for car wheels this country has to give occasional foreign orders. Other castings figure in the imports. Altogether it is safe to say that the country requires at least 100,000 tons a year of pig iron, of which about one-fourth is supplied by the home manufacturer. The estimate is largely within parliamentary statements of course, but that it is respectable at least, appears from the fact that the quantity demanded is ten-thirteenths of the production of Great Britain at the beginning of the century.

How far charcoal pig will meet the ordinary requirements of the founders' trade, the Ontario Mining Commission report may tell us. Mr. Copp, a large foundryman, says: "If we used one third charcoal we could use English and low grade Scotch iron, and turn out a strong nice plate. It seems to me strange that some person has not started the manufacture of charcoal iron in Ontario. If our machine men used more charcoal iron in their castings they would be of a better class, and it would be better for for the country. As soon as it is established that charcoal iron makes better work we will all be willing to pay more for it." Mr. Adam Laidlaw, another extensive iron-founder, says: "I think we could use charcoal iron mixed with the Scotch; it would strengthen and improve the castings." H. A. Massey, of the great agricultural implement concern—who by the way, have now, agencies in Great Britain, and have there entered the lists against the British manufacturer—says: "I think that at Oshawa they use from 2,000 to 3,000 tons of charcoal iron for malleable castings. If Canadian charcoal iron could be produced for a little more than Scotch or Londonderry, (the prices of which he had given at $18 to $22), no doubt we could use it for nearly every kind of iron we want to make. For machinery castings we want the best iron, and the expense is what has kept us from using charcoal iron. I would take charcoal iron at $24 a ton rather than imported iron at $22. I would consider it to be $4 a ton more valuable. The manufacturers of agricultural implements would use it; and if one used it and made better castings, competition would compel the others to do likewise." Mr. Massey went so far as to recommend a bonus of $2 a ton, "in addition to the present bonus and duty," provided it could be shown that at present prices makers do not get a profit of $6 a ton. Thus the three leading founders in Ontario concur in the view that charcoal pig is a necessity if high class manufacture is required as well for stoves as for malleable castings.

The going charcoal iron concerns, if they have not been invariably financially successful, have at least earned the credit, as one witness stated it, of "making a magnificent quality of car-wheel iron." The demands of this branch of the trade have not been overtaken by Canadian makers within several thousands of tons yearly, variously estimated, from 5,000 to 10,000 tons. Though the adept smelter can make a mixture which will turn out a well-chilled car-wheel from the furnace, thus getting by a direct process, a product worth $40 a ton compared with pig iron at $22, the manufacture of car wheels is generally a special foundry business, in which the character of the work turned out depends in chief upon the mixture of various irons and skill in casting. The demand grows with the requirements of the carrying trade, and bids fair to assume such proportions that it should become a fixed industry, keeping in activity an additional 30 ton furnace. If to this demand is added the requirements of the stove and implement trade, it will be easy to dispose of an additional output of 20 tons daily, thus accounting for the sale of 18,000 tons yearly. But as no furnace, however well managed, gives a uniform product, but rather grades its production into three or more varieties of iron, such as grey, mottled, and white iron, each good of its kind, but having special qualities for the founder or the refiner, so it becomes requisite to consider the possibility of establishing as an adjunct to charcoal iron manufacture either puddling or open-hearth steel furnaces. If phosphorous and sulphur be mentioned as possible difficulties, it may be answered that where the steel-works adjoins the furnace the pig can be sent hot to a cupola carrying a large burden of lime, where with the addition of low phosphorus pig and scrap a dephosphorized iron can be obtained for transfer to the gas furnace. The operation of the Siemens' regenerative furnaces at Bethlehem and Steelton, Penn., with Lima oil and super-heated steam, is now conducted with so much ease in firing and economy of fuel that gas generating for the steel boiler is an almost automatic process, the stoker being entirely dispensed with. Said the superintendent of the Bethlehem Iron Company's steel furnaces to the writer a few weeks ago, "we now do with two men at our fires the work which required 25 men, and get better work done, gaining working space and comfort every way." Mr. Massey, in his evidence before the Ontario Mining Commission, stated that it "is most important something should be done to encourage the manufacture of steel. We import some from England and some from Johnstown, Penn. They supply at Johnstown an article quite as cheap as in England, but of better quality. We have been trying to get the Government to take the duty off cold steel, or to get some one to manufacture it. I think the business in Canada would pay. It would take a very large establishment to supply the requirements of the country in that line of goods. If there is anything that should be encouraged it is the manufacture of steel. Charcoal iron is in the right direction, but steel is the most important." Mr. Massey does not in the least over-rate the importance of encouraging steel manufacture, but in view of the fact that the average duty on manufactured steel is 38 per cent., there surely is no need for further inducement to enter upon the manufacture. If a good home market and a high tariff with a certainty that steel making has a firm hold of the requirements of the people, and that the processes now successfully carried on make the production of soft steel or ingot iron cheaper and more easily managed than the craft of the puddler, if these do not give sufficient encouragement to the enterprise, it is difficult to see what form the encouragement should take.

The plant of a 15 ton Siemens' furnace, including cost of building, was estimated for certain parties in Ontario by competent engineers at $25,000. This estimate contemplated an output of 45 tons of steel blooms and billets per day, manufactured from imported pig and worn-out Bessemer rails. Steel scrap is free of duty. This source, as well as that from the yearly turnout of old rails from roads west of Montreal would afford a sufficient supply. Instead of importing pig, the better plan would be to erect a 50 ton charcoal furnace, taking from it about 20 tons a day of forge iron for the steel furnace. For the blooms and billets there is an existing demand of about 10,000 tons a year from the wire-rope makers and rolling mills. Structural specifications demand sufficient to justify the erection of a rolling mill for turning out 8,000 tons yearly. Bar iron is being displaced in every direction by good ingot iron or Siemen's steel. Should this branch of work be entered upon, the demand would absorb 16,000 tons a year. A $25,000 Siemen's furnace, driven to its utmost capacity, would turn out 13,500 tons a year, or 40 per cent of the demand. If the manufacture of crucible cast steel, as suggested by Mr. Massey, should be entered upon, a small additional plant for operating with a Darby or some other carbonizing process—even a cementation furnace or two—would probably be a profitable experiment, conducing to wider enterprise.

Any extension of the charcoal iron industry must reckon with American competition. In fact if the importation from the United States, equal to 35 tons a day, could be cut off by the home manufacturer, it would be an augury of new undertakings. The cost of assembling materials at northern coke furnaces, from certain instances quoted in a return by the United States Commissioner of Labor, ranges from $4.04 to $5.92 per ton of iron made, the factors being in the:

	1st Case.		2nd Case.
Ore, freight, 812 miles..	$2.174	1,000m.	$4.287
Coal, " 105 " ..	.067		
Coke, " 132 " ..	1.578	140 "	1.474
Limestone, freight, 25 miles............	.223	25 "	162
	$4.042		$5.923
Total cost of iron..	12.568		14.858

The large ratio of freight to cost of production is a feature which should have its significance, when it is considered that Ottawa, Kingston or Toronto are in the neighborhood of supplies of ore, fuel and flux, the charges for bringing which to the furnace should not, at the utmost, exceed one-half of the cost in the first above instance quoted.

◆

Bush Fires and Mining in Quebec.

When a capitalist, usually a foreign one, is induced to invest his money in Canadian mining lands, he naturally considers in his calculations for developing the same not only the mineral but all the resources of the property which are likely to make his investment a profitable one.

If there is sufficient water power on or near his land for driving mining machinery, so much the better. The use of machinery in mines becoming more necessary year after year, the means of operating this, and the working expenses of the same, are a question of the utmost importance.

The use of water power, involving merely the first outlay in plant—the working expenses and cost of transmission being comparatively small—it is of the greatest advantage to a mine proprietor if he has such a power at his disposal.

At first sight these comparatively gratuitous sources of power seem to exist in wonderful profusion in Quebec, and are, indeed, commented on and held out as an additional inducement by land speculators having mining properties to sell in the Province.

Their availablity is, however, pretty much a delusion, and it is most rare for an investor to find water rights which can be secured for his work, and he usually discovers these to be already secured by speculative monopolists, who do not use them "who toil not, neither do they spin,"—but who find it more profitable to hold them for further speculation in the future; a system, by the way, inimical to all industrial development, and likely enough in the near future to cause trouble when educational enlightenment shall show that "Vox populi, vox Dei."

Lacking water he must use steam power, and to generate this must have fuel in the shape of coal or wood.

The former is too far away and too expensive for economical use, except in very rare instances in the Province of Quebec—the mines being for the most part in remote and inaccessible regions—and is therefore out of the question for the present.

The latter, however, is quite another thing, and would appear practically available everywhere and inexhaustible in quantity.

Viewed at a distance, the Laurentian mountains seem to be covered with dense forests sufficient to supply the country with timber and fuel for industrial and domestic use for ages to come.

On a closer inspection however this also turns out to be somewhat delusive. For the most part the primeval forest has entirely disappeared, what remains being principally second growth timber and brush. The gigantic pine stumps still standing, and the prostrate and decaying trunks, show how ruthlessly the harvest has been cut and how thriftlessly gathered: how many trees have been felled to rot and waste, and how few culled for use; the second, yet still luxuriant growth of inferior timber, in spite of the absence of all planting, recording at once the grand productiveness of the soil and the reckless waste of those who have cut down but planted not. Recording at the same time the culpable negligence of a government which has impoverished its subjects by licensing a few individual lumber monopolists to enormously enrich themselves out of the natural produce of the land at the expense of the many future tillers of the soil, to whom this timber would have been a source of immediate return, and alone made it profitable to cultivate on economic principles a country which would then not have been deforested.

The wasteful lumber system, and the annual destruction of thousands upon thousands of acres of timber through the fearful and barbarous custom of bush firing, and the absence of any scientific forestry and woodcraft, are rapidly deforesting even this superbly wooded province. And it can be easily foreseen that unless active measures of reform are put in force by the passing of more stringent legislation, in addition to the stricter enforcement of the existing regulations by the rangers, who are too few in number, and whose supervision is of too perfunctory a nature to be efficient, vast districts of the country will be left without timber for building and fencing, and without fuel for burning.

Year after year cordwood is becoming scarcer, dearer, and farther afield. In many mining districts its price has become prohibitory for steam raising purposes, and it may safely be predicted that without water power, or fuel for steam power, many mines will be obliged to close down, or worse still, unable to open at all. Mining labor is dear in Canada compared with that of European countries, with whose markets she has to compete, and where steam fuel is cheap.

To say no more respecting the value of wood, as fuel, to the miner, let us consider its value to him in his work, as timber. In many kinds of deep mining vast quantities of wood are required for timbering and stalling. Buildings for workshops, dressing floors, and machinery, are more than usually necessary in a climate like that of Canada. Many mining companies on account of their isolated situation, away from manufacturing centres, find it necessary to construct their own plant, such as tram cars, waggons, derricks, gins, etc. Their workmen are often from a distance, and dwelling houses for families, boarding houses for single men, and stores for provisions and supplies must be built, and these all necessitate the use of timber, and unless it is on the property or sufficiently near to be cheaply hauled, it is out of the question for mining to be carried on profitably, for the expenses of outfit and maintenance would be too great for the output, ever to recover the first outlay, save perhaps in the mining of precious metals, which are of course an exception to mining generally.

After thus far considering the value of timber and cordwood to the miner, and how important a factor it is in his calculations when purchasing mining property, we will assume that he has made his purchase of land and minerals, paying an increased price for the large quantity of both hard and soft wood growing on his sett.

His method of operation is decided on, his plans made, and with the disappearence of the Canadian winter and the first advent of spring, soon begins to make good progress in the preliminary work of the mine.

Is it possible for a Canadian to imagine the stranger miner's surprise, a little later on, to find the surrounding country a burning mass of fire and smoke, and the farmers and settlers all round for once seriously at work diligently lighting up fresh fires? His own valuable forest in flames; perhaps his already erected buildings destroyed or in immediate prospect of being so; perhaps his wife and children and their home in danger; his expensive staff of miners employing their time in fighting bush fires instead of mining. Perhaps not; but the picture is not overdrawn, and this happens year after year. The property he purchased is in a measure destroyed; he feels there is but slight security for property, and experiences a feeling of distrust in the government. The calculations he made are upset, but a new factor comes into them, and he is able to calculate that in a few years the fuel resources of the country will be burnt out and that mining on economic principles will be no longer possible.

In the Province of Quebec this sort of thing happens every spring, and lasts for a period of nearly two months. In many districts the devastation is already complete, as the forest is all destroyed and there is no more timber to burn, and yet the land remains uncultivated.

It will naturally be thought that in the face of such a state of things, the laws for the prevention and regulation of forest fires are inadequate, but such is not the case. Special provisions have been made by law, and the statutes revised, but with little effect.

It may, however, be taken for granted that these regulations are not made sufficiently public, and though ignorance of the law cannot be pleaded as an excuse for breaking it, still ignorance may be the reason it is broken.

Probably the indifference shown by the Crown Timber Department of Quebec to the complaints constantly laid before it, is at the bottom of the whole trouble.

It is quite certain that if the originators of these fires knew the penalties they run the risk of incurring, the liability incurred by damaging a neighbor's property, the restrictions imposed, and the precautions to be observed, even when the law permits such fires, they would very rarely dare to start a bush fire at all, even for the purpose of legitimate clearing.

Notices of the regulations ought to be posted up at every post office, and on every church door in a township at the commencement of each customary period during which such fires occur. The Forest Rangers employed by the Department should give effect to the regulations by constant and watchful supervision in those districts to which complaints have referred and by cautioning suspected offenders of the penalties they incur.

In conclusion, let not Canada fail to profit by the experience of older countries of Europe, which, after thriftlessly wasting their timber resources for centuries, have now, by the effect of the wise laws of enlightened statesmen and the establishment of forestry schools, set an example to the world, and secured for their descendants the preservation of the woodlands and a moderate but inexhaustible supply of timber of all kinds for commercial and industrial use forever.

Notice.

All communications on business of the General Mining Association should be addressed to Mr. A. W. Stevenson, 17 St. John Street, Montreal, who will act as interim secretary during Mr. Bell's absence.

Extraordinary General Meeting of the General Mining Association.

An extraordinary general meeting of the General Mining Association of the Province of Quebec was held on Wednesday, the 5th inst., at the office of the treasurer, Mr. A. W. Stevenson, 17 St. John street, Montreal. The mining interests of the Province were well represented, among those present being Mr. Wm. White, of Sherbrooke, representing the Eustis Mining Company; Colonel Lucke, of Sherbrooke, representing the Beaver Asbestos Company; Messrs. S. L. Spafford, representing the Nichols Chemical Company; D. A. Brown and Captain Sheridan, representing Bell's Asbestos Company; J. Lainson Wills, general manager of the General Phosphate Corporation; S. P. Franchot, Emerald Mining Company; W. T. Gibbs, Dominion Phosphate Company of London; Captain Williams, Bristol mines; W. H. Jeffrey, Richmond; Irwin, Hopper & Co., Wm. Sclater, O. M. Harris, Dr. Killing, Dickson Anderson, F. Hilton Green, A. Lomer, Theo. Doucet and Geo. Stewart.

The chair was taken by Mr. S. P. Franchot, who briefly stated the object of the meeting, which was to take into consideration the proposed application by the Provincial Government of the mining law passed last session, the Government having sent out to the various mine owners schedules to be filled in and returned, giving particulars as to output, shipping point, destination, etc.

After a long discussion in which most of the members took part, the following resolutions were passed :—

Moved by Mr. W. H. Irvine, seconded by Mr. W. H. Jeffrey, "That inasmuch as a petition has been presented to the Governor-General in Council praying for the disallowance of the Quebec Mining Act, passed at last Session, it is deemed advisable and hereby resolved, that pending a decision upon the said petition, the members of this Association be and are hereby requested to refrain from completing and returning to the Crown Land Department of the Province of Quebec, the affidavit and quarterly report recently issued by said Department, and that a copy of this resolution be forwarded to each member of the Association."

Moved by Mr. A. W. Stevenson, seconded by Mr. O. M Harris, "That all matters arising out of the enforcement of the mining tax or royalty referred to in the preceding resolution, be left in the hands of the Council of the Association."

The meeting then adjourned.

The Mineral Resources of Hudson Bay.

The Winnipeg and Hudson Bay Railway Bill has just received its third reading in the Senate. The general character of the country through which the road will run is not familiar to Canadians, and the following letter of Dr. Robert Bell to the Minister of the Interior may interest our readers :—

"GEOLOGICAL SURVEY,
"21st July, 1891.

"HON. EDGAR DEWDNEY, M.P.,
"Minister of the Interior,

"SIR,—In connection with the discussion of the Hudson Bay Railway, the following notes, on the resources of the country, near the proposed line, may be of interest.

"First, in regard to economic minerals. On the line, as projected between Lake Winnipeg and Manitoba, extensive deposits of gypsum occur, immediately under the surface of the ground, over a considerable area of the north-west of Lake St. Martin. The mineral is easily recognized, and the Indians report having found it also further to the north, as we might have expected from the known geological structure. The value of this substance as a manure can hardly be over-estimated, and there is no other known source to compete with this locality for the supply of Manitoba and the north-western States.. If these deposits are made available by the construction of a railway, there would also be a large demand for the mineral for other purposes.

"Next, I would mention the brine springs near the northern and southern extremities of Lake Winnipegoosis, at both of which localities excellent salt was manufactured before the railways had reached Manitoba. The rocks at these localities are of the same geological age as those from which salt is derived on the eastern side of Lake Huron, and there is every reason to believe that abundance of strong and pure brine could be obtained by boring at the former, and that all the salt required in the North-West might be made here, thus saving the long transportation from the east.

"The discovery of amber at Cedar Lake promises to be of importance, and the local industries connected with the utilization of this substance may hereafter support a considerable population, as is the case in East Prussia. This unexpected discovery is an instance showing the great possibilities which that vast region possesses in the way of mineral resources.

"A specimen of quartz brought from Pelican Narrows, further to the northward, by an assistant of mine in 1881, was assayed in the laboratory of the Geological Survey, and found to contain a small quantity of gold.

"A promising deposit of hematite ore occurs on Black Island, in Lake Winnipeg. This iron ore might be smelted in the vicinity of Grand Rapids, at the mouth of the Saskatchewan, by bringing coal from the west to meet it there. A railway to that point would give a great impetus to such an enterprise.

"The fall at Grand Rapids amounts to about 100 feet, thus affording an almost unlimited water power. In a vast region where important water powers are so scarce as they are in Manitoba and the North-West Territories this fact has great significance when we consider the future requirements of that great country.

"I have made a survey of the Nelson River, all the way from Lake Winnipeg to Hudson Bay, as well as of the boat route from Norway House, by way of Oxford Lake and Hayes River to York Factory, and also of the Little Churchill River and the Great Churchill, from the junction of the latter all the way to the sea, and I am therefore in a position to speak with confidence of the country through which these rivers flow. The total fall from Lake Winnipeg to the sea amounts to 710 feet, or an average of about a foot and a-half to the mile. The general aspect of the country on either side of the Nelson River is level, with banks of clay on either side, as illustrated by numerous photographs which I took all along. There are points or rock, of course, where the falls or rapids occur, but the proportion of rock to soil is comparatively small.

"Excellent wheat is grown at Norway House on the right bank of the river, 27 miles below Lake Winnipeg, where, I believe, it is a sure crop every year, and also at Cross Lake, more than 50 miles down the river. Some years ago I sent a variety of vegetable seeds to be sown for experiment in the Indian gardens at Cross Lake, and the results were extremely favorable—at one time a considerable quantity of barley was grown at Oxford House.

"I attribute the fine summer climate of that region to its comparatively slight elevation above the sea, and to the prevailing south-westerly winds, carrying the heat of air from the surface of the warm waters of the Lakes of Winnipeg Basin over a broad belt of country of the north-eastward.

"Yours faithfully,
"ROBERT BELL."

An Interesting Plant.

There has recently been set in operation at the Kensal Green Gas Works of the London Gas Light and Coke Company, a most interesting plant, which automatically takes eighty tons of coal per hour from the barges on the adjacent canal and passes them direct part to 500 retorts and the other part to thirty-eight stores. For nine hours each day the plant carries out the work satisfactorily with only slight supervision. On the wharf are two crane elevators moving on wheels, and fitted with ordinary grab buckets, which raise the coal from the barges and drop it on to a hopper formed of large screens placed at an easy angle and ending at the lower end or apex in a shoot. The larger pieces of coal, forming 10 per cent. of the total, which do not go through the sieves of the screen, pass through the shoot to a coal breaker, and from thence by gravitation to what is called a "conveyor." The small pieces which go through the screen also gravitate to the conveyor. The eighty tons of coal, made into convenient sizes for use, are taken along an underground passage, thirty-five feet long, by this mechanical conveyor. If the reader can recall the appearance of a leather belt moving in a horizontal plane, and winding round two large pulley wheels placed about thirty-five feet apart, he will be able to understand the mechanism. The belt, however, instead of being of leather, is made up of a number of flat steel square trays placed closely together, and attached in the centre at the back to an endless chain, winding round and moved by the pulley wheels. As each successive steel tray passes round the pulley some coal passing through the shoot drops on to the top, and it continues to move forward till the other pulley is reached. As it winds round the wheel the coal is dropped down a slight incline. The coal in each successive tray is caught in this incline in one of a number of buckets attached to a chain working in a vertical plane around two wheels, one at top and the other at bottom, and in this way the mineral is raised to a height above the level of the retorts in which it is to be used. The buckets work in the same way as in a dredger. At the top the material is thrown into a hopper so constructed that it passes thirty tons per hour into a conveyor, which distributes the coal along a double setting of retorts extending 400 feet in length and containing 500 retorts; while the remaining 50 tons per hour is distributed into thirty-eight stores for the night supply or reserve stock. These stores are on each side of the retort house, and the fifty tons of coal pass from the hopper down two shoots, one on each side. The arrangement of this conveyor is different from the others, as it was necessary to so adopt it that it could deposit coal at almost any point. Each conveyor is about 370 feet long, and may drop coal in the stores underneath at intervals of from twenty to thirty feet. A channel, which may be likened to the gutter alongside the curb, is formed above the stores, and at either end there are wheels round which revolve chain gearing, attached to which at short intervals are plates of T iron, and as the chains revolve the sharp edges of these pass along the channel pushing the coals forward. The coal falls into the channel at one end, and each successive plate draws along its own quantity. In the channel there are trap doors at intervals, so that the material may be allowed to drop at any point. There may be many adaptations of conveyors. For the night service the coal is drawn from the coal stores into two conveyors, each 400 feet long, fixed underneath. These deliver it into the elevators, which in turn supply the tilting scoops at the retorts. All the conveyors and elevators are worked by the interposition of belting. The plant is said to be the most extensive conveying plant in the world.

A few Practical Notes on Pumping.*

By William Archibald.

At a meeting of the Institute held in Edinburgh on the 31st of January last, Mr. John Durie suggested that the Council should make an independent and exhaustive inquiry as to the relative efficiency of different kinds of pumping engines. It is not with the view of supplying Mr. Durie with that information that this short paper has been written, but he has touched upon a subject of great breadth, and one there is ample scope for the members of the Institute to work upon. Valuable and thoughtful papers have been contributed by Mr. M'Creath, Mr. Baird, Mr. Andrews, Mr. Landale and Mr. Moore, but there yet remains a large field untouched. Mr. Durie's suggestion would be all the more valuable and productive of practical results, if a number of consecutive papers were read, descriptive of the various kinds of pumps and pumping engines that are working at our respective collieries. There is abundant material to work upon, although one were only to describe the various kinds of special steam and hydraulic pumps that are at work. If each member would contribute to the Institute his experience, be it ever so little, of pumps, pumping engines, and the class of pump rods used, etc., or even if he were only to describe plainly the class of pump or pumps under his charge, without going into technical or theoretical details, a mass of very desirable information would be added to our *Transactions*, and be of inestimable value to those about to fit up new winnings. It is sometimes a very ticklish point indeed to decide what kind of pump will be the best to fit up under certain conditions. Suppose one decide on fitting up pumps of a fairly large description, it is generally too expensive an operation, and not always expedient to discard one class of pump for a different, or perhaps a better class, even assuming a mistake has been made in arriving at the first decision. My experience has been mostly confined to large, or rather heavy fittings, but I have nothing new or original to set forth in this paper, but merely wish to describe a direct acting pumping engine and pump, erected at No. 10 pit, Haywood, belonging to the Haywood Gas Coal Company. The engine was made by Messrs. Turnbull, Grant & Co., Canal Basin, Glasgow, and was erected in 1873. Plate II., shows the side elevation. The steam cylinder, which is 84 inches in diameter, is placed directly over one end of the pit, and has a stroke of 12 feet. The beam over the engine is made of malleable iron plates, 3/4 inch thick, and is 21 feet long, over all, with cast iron distance pieces riveted to the sides. One end of the beam is attached to the piston rod, the other end slides, in cast iron guides, with ordinary slide blocks, resting on two strong wood beams built into the walls of the engine house. The vertical motion of the piston rod is maintained by means of two motion rods, fitted on each side of the beam nearest the piston.

To illustrate Mr. William Archibald's paper on PUMPING.

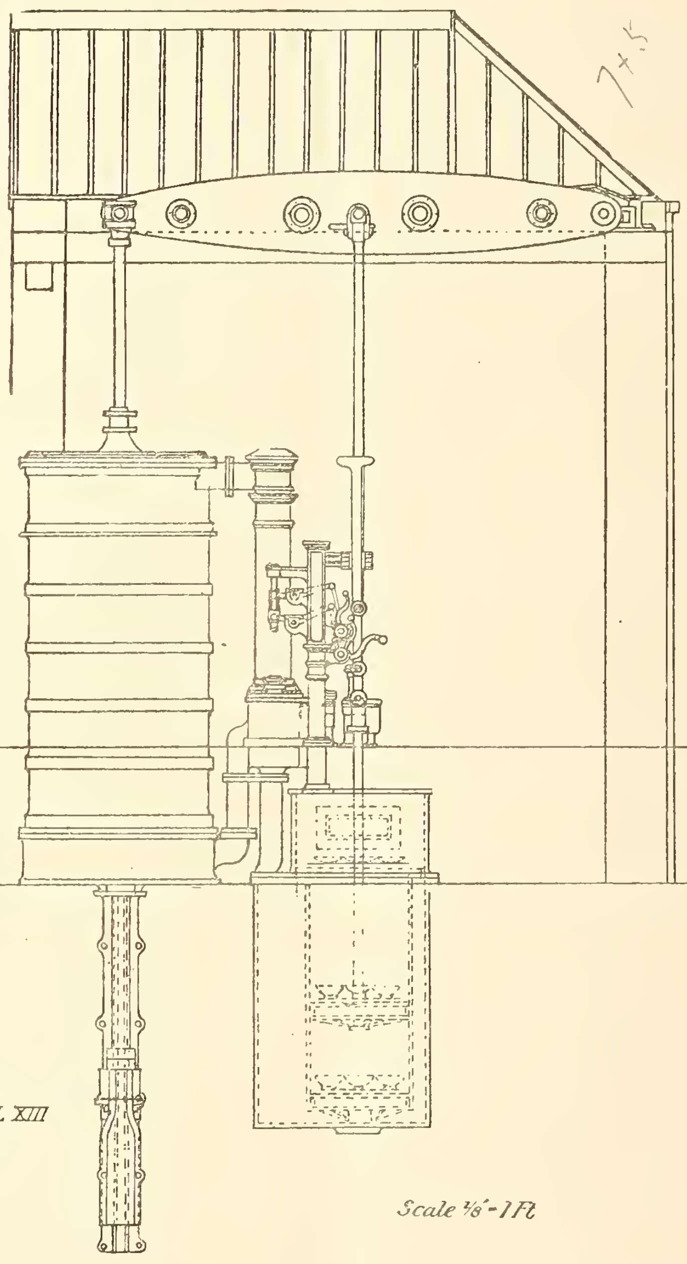

PLATE II VOL XIII
M. I. S

It will be observed that the piston rod connecting the beam with the cylinder is very small, compared with the other dimensions of the engine, being only 4½ inches in diameter. The only work this piston rod and beam have to do is simply to lift and lower the tappet or plug rod for opening and shutting the steam and exhaust valves, and to work the condenser pump. The steam acts only on the under side of the piston, and after doing duty in lifting the pump rods, is exhausted into the condenser, which is connected with the top of the cylinder, and the downward motion of the pump rods is retarded. Of course the steam in the cylinder can be throttled in its passage to the condenser, thus also preventing the pump rods descending too rapidly. The weight of the pump rods in forcing sets is generally in excess of what is required for forcing the water.

CONDENSER.

The condenser pump, (plate III.), which is worked from the beam by the tappet rod, also the top and bottom valve seats, are fitted with disc rubber valves about 16 inches in diameter by 1 inch thick. There are 18 of these rubber valves connected with the condenser and pump; each valve is held in its position by cast iron saucer-shaped guards, bolted to the valve seats by 1⅜ in. bolts. It is very essential in engines of this type that these rubber valves be made of the very best material that can be got. If worthless valves are put in, the vacuum is affected and valuable time lost in renewing them that often cannot well be spared when the growth of water is heavy, requiring the engine to work night and day all the year round. I have seen good rubber valves stand from one to two years, the engine going steadily from 2½ to 3 strokes per minute; and others not lasting one half of that time. The pit water, which is corrosive, sometimes eats through the top and bottom valve seats of the condenser, but of course the extent of this altogether depends upon the nature of the water supplied to the condenser. The pit water was used for our condenser, and only one of these valve seats—the bottom one—had to be taken out, after having been at work for fully 14 years. It was specially arranged once a year, about the month of August, when the growth of water was light, to stop the engine from 14 to 16 hours to draw the condenser pump, examine and renew (if need be) the valves, and clean the valve seat gratings, which got choked up with a heavy sediment that was in the water. The vacuum was always at its best, and the engine generally worked more smoothly after these periodical examinations.

ELEVATION.

The end elevation of the engine (plate IV.), shows the main piston rod, 9½ inches in diameter, which passes down through the bottom of the cylinder, and catches the pump rods at a cross head which works in ordinary cast iron slides near the top of the shaft. This cross-head and the top ram is connected by two sets of parallel pump rods 18 inches apart. These parallel rods (plate V.), are in various lengths, from 24 to 32 feet each, are pitch pine, 12 inches square, and double plated with iron plates at each joint, each set of plates being respectively 12 and 11 feet long, 9 inches broad, and 1 inch thick. There are 30 bolts 1⅛ inches square at each joint, 16 bolts in one pair of plates, and 14 in the other. Between these pump rods are round iron bars nailed to the rods, about two feet apart. These are put on as a step for the purpose of travelling up the pump rods. The pump was stopped an hour or two every week for the purpose of having an examination made of the pump, rods, plates, bolts, etc., from the ram to the surface. Beyond screwing up a loose nut here and there, no trouble was experienced with these rods from one end of the year to the other. With good strong fittings well put together to begin with, it is surprising the small amount of tear and wear in rods of this description, and the trifling expense required for their maintenance when we consider that they send to the surface fully 300 tons of water per hour, and over two and a half million tons per year. During the six years these pump rods were under my charge, no plate or rod broke in this set of rods, and I am not aware that a single rod or plate has been broken since they started to pump 18 years ago.

THE RAM

is of the ordinary description, 32 inches in diameter with a 12 ft. stroke; and, considering the work it has done, it is in first class condition. It was packed with the ordinary white rope, pleated about 2 or 2½ inches square, well steeped in tallow, along with two or three turns of common patent packing at the top. The ram had to be packed every six months. Considering the good condition of the ram, I had always a notion that we used more packing than was required, but attributed that to the contracted area of the

RISING MAIN

putting more pressure on the packing than it otherwise would have done if the rising main had been equal in area to the ram. The rising main is made up of two columns of pipes (plate V.) above the air vessel, 15 and 20 in. each in diameter, the respective areas of which combined is not much more than half that of the ram. These two columns that form the rising main were lying on the ground not in use before this set of pumps were put in, and, consequently, were utilized for the purpose described, otherwise they would never have been where they are.

THE AIR VESSEL,—(Plate VI.)

has a capacity of 27 cubic feet, the capacity of the ram being 67 cubic feet, or nearly 2½ times that of the air vessel. Although the capacity of the air vessel is small compared with the ram, I am not aware that the engine or pump rods ever suffered from shocks due to air in the rising main, because the velocity of the water never exceeded 45 feet, and generally not much more than 30 feet per minute. There was also a 2 in. pipe from the discharge clack door for the purpose of running back water into the lodgment, to keep the ram on solid water. This back water pipe was frequently used, and consequently, relieved the rising main of any air that would have collected. The valve of this pipe was opened and shut by the engineman. A wire from a float in the lodgment was led into the engine house which showed the condition of the lodgment, and the valve was regulated accordingly. The ram casing, clack pieces, and rising main rested on three strong cast iron girders, 12 feet long, 2 feet 6 inches deep, and 6 inches broad.

CLACKS.

The suction and discharge clacks (plate VII.) of this forcing set are of the ordinary flap type, about 3 feet in diameter mounted with three plies of leather, with plates riveted top and bottom in the usual way. The clack seats had bars cast across their diameters for the purpose of strengthening the clacks, and had an angle of 20° for the lids to work upon. The following are the dates when the clacks were changed, and the number of days each clack worked for ten years:

SUCTION CLACK—FORCING SET.

Year.	Month.	Days Worked.
1876	October 28th	...
1877	October 11th	348
1878	September 28th	352
1879	August 23rd	329
1880	September 18th	391
1881	December 11th	449
1882	July 3rd	204
1883	April 2nd	273
1884	January 14th	287
1885		...
1886	March 29th	804
Average		381

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* Trans. Mining Inst. of Scotland.

D SCHARGE CLACK—FORCING SET.

Year.	Month.	Days Worked.
1876	November 11th	...
1877	October 13th	336
1878	March 17th	155
1879	April 7th	386
1880	July 19th	468
1881	December 12th	511
1882		...
1883	April 14th	488
1884	August 30th	503
1885		...
1886	March 29th	576
Average		427

To illustrate Mr William Archibald's paper on PUMPING.

7x2

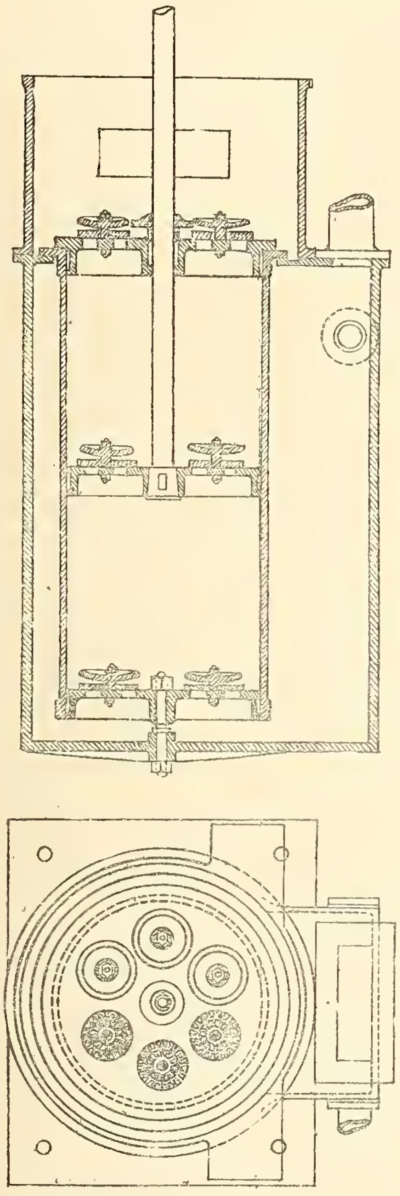

PLATE III. VOL XIII
M. I. S.

Scale 1/4"=1Ft.

To illustrate Mr William Archibald's paper on PUMPING

7¼+4½

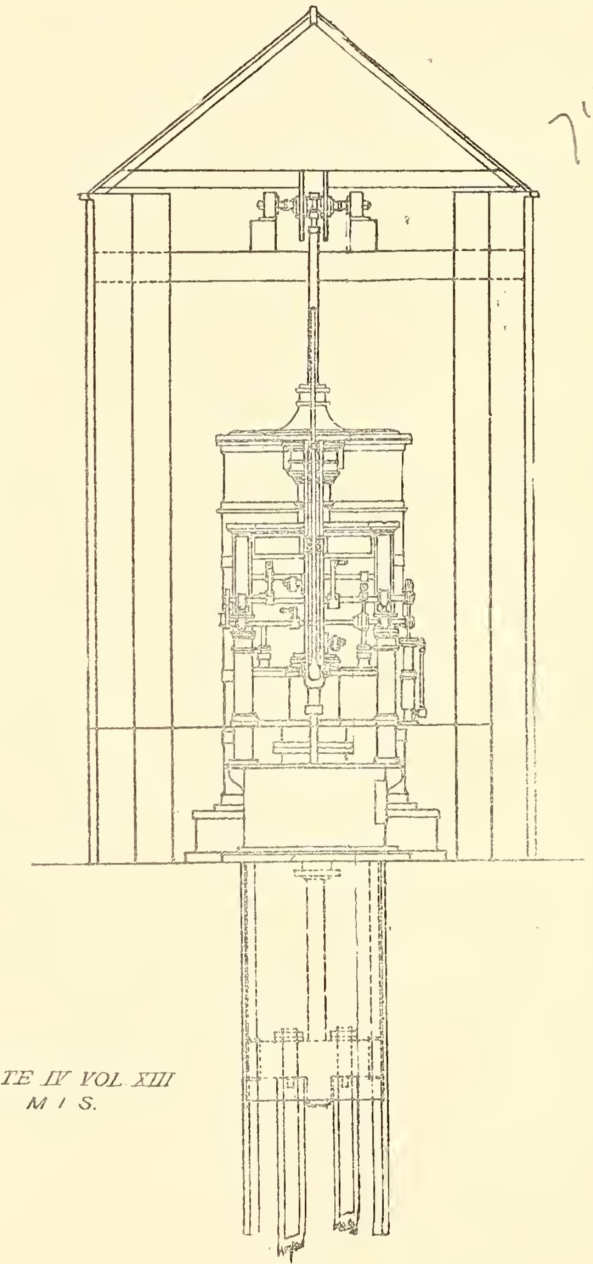

PLATE IV VOL. XIII
M. I. S.

Scale 1/8"=1Ft.

In ten years there were nine suction and eight discharge clacks put in, the average days worked being 381 and 427 respectively.

BUCKET LIFTS.

From the surface to the top lodgment was fifty, from the top to the mid lodgment fifteen, and from the mid lodgment to the bottom ten fathoms—total depth seventy-five fathoms. There are two bucket lifts under the ram, and the shaft being only 5 feet 6 inches wide, left no space for wood rods to pass the clack pieces of the forcing set, down to the bucket lifts, consequently iron rods 5½ inches by 3½ inches had to be put in from the apron past the top lodgment, where they catch the wood rods from the lower lifts. The first bucket lift, as stated, is fifteen fathoms. The diameter of bucket is 30 inches, the rods of which are from 30 to 32 feet long each, pitch pine, 12 inches by 10 inches, and double plated with iron plates, 12 feet long, 9 inches broad, and 1 inch thick, and 30 bolts 1⅛ inches square at each joint, similar to the forcing set. The bucket was mounted with gutta percha, the lids being of leather, lying also at an angle of 20° as the clack lids.

30 IN. BUCKET.

The following are the dates when the 30 in. bucket was changed, and the number of days each bucket worked for ten years :—

Year.	Month.	Days Worked.
1876	June 10th	...
1877	March 29th	292
1877	May 5th	37
1878	May 4th	364
1878	November 16th	196
1879		...
1880	May 4th	534
1880	July 15th	72
1881	June 25th	345
1882	July 4th	374
1883		...
1884	January 12th	557
1885		...
1886	June 26th	895
Average		366

The second bucket lift under the ram is ten fathoms ; diameter of bucket 24 inches. The rods are also pitch pine, from 24 to 32 feet long each, with two iron plates at each joint, 10½ feet long, by 7 inches broad, and ¾ inch thick with twelve bolts 1 inch square.

24 IN. BUCKET.

The following are the dates when the 24 in. bucket was changed, and the number of days each bucket worked for ten years :—

Year.	Month.	Days Worked.
1876	June 10th	...
1877	February 27th	257
1877	September 8th	198
1878	April 27th	231
1878	September 7th	133
1879	August 2nd	329
1880	July 3rd	335
1881	September 24th	448
1882	December 2nd	434
1883		...
1884	January 19th	413
1884	September 28th	252
1885		...
1886	October 2nd	734
Average		341

The pressure on the 30 in. bucket was about 40, and on the 24 in. only 26 pounds per square inch. Still the life of the 30 in. bucket was greater than the 24 in. one, although it had much more work to perform every stroke. Why one bucket in the 30 in. set should do eight times the work of another, all things being equal, is a question that would not be easily answered. In fact, I do not know that any tangible reason can be given for the difference in the amount of work performed by each bucket. All the buckets for the ten years given were mounted by the same person, and the best quality of gutta percha was always bought and the highest price paid. Still there is not the least doubt that their life was often shortened by adulterated and inferior stuff. The average life of the lower bucket was less than the top one, but that was, I believe, in a great measure due to frequent cleaning of the lodgment. The stirring up of the mud and gritty matter while the lodgment was being cleaned, no doubt helped to destroy the lower bucket. The 30 in. bucket got practically no water but what the 24 in. one delivered to it. The working barrels in both sets were in good condition.

BUCKET CLACKS.

The following are the dates when the 30 inch bucket clack was changed and the number of days each clack worked for ten years :—

Year.	Month.	Days Worked.
1877	January 12th	...
1877	May 5th	113

Year.	Month.	Days Worked.
1878	July 26th	417
1879	November 26th	488
1880		...
1881	January 21st	421
1882	July 8th	533
1883		...
1884	January 15th	558
1885		...
1886	January 23rd	736
Average		466
24 IN. BUCKET CLACK.		
1877	February 22nd	...
1877	October 13th	233
1878	March 23rd	261
1879	February 8th	322
1880	February 3rd	360
1881	May 31st	483
1882	July 8th	403
1883		...
1884	January 18th	559
1885	January 17th	364
1886	May 25th	493
Average		355

While the average life of the 30 in. and 24 in. buckets were 366 and 341 days respectively, in ten years, or twenty-five days in favour of each 30 in. bucket, there is still a greater difference in the life of the clacks. Seven of the 30 in. one were put in, and nine of the 24 in. one in ten years, the average days worked being 466 and 386, or 80 days in favour of each 30 in. clack. The 30 in. clack had certainly a greater pressure to sustain than the 24 in. one; but undoubtedly, if the cleaning of the lodgment told against the life of the lower bucket, it must also have done so in the case of the lower clack.

Five or six pits were working, and in each pit dooks were driven to the dip off the pit bottom. Three or four of these dooks had bucket pumps from 16 inches in diameter and upwards going night and day. These dook pumps were driven by the shaft pump rods with cast iron cranks in the pit bottom. These cranks had to be restricted in their size for getting them down the shafts, 5 feet 6 inches being the widest. The arms of these cast iron cranks were naturally short, and consequently put a considerable radius on the shaft rods when the stroke was long.

The tear and wear on the crank seats and plummer blocks was very great, due to the short leverage, and it was decided to put in malleable cranks. These cranks (plate VIII.) were made by Messrs. Kesson & Campbell from a design of my own, and were a considerable improvement and saving compared with the cast iron ones. There was practically no restriction as to their size.

They could be easily fitted up and taken to pieces, and were light and strong. One of these cast iron cranks worked for some years the dook pump on the forcing principle, that is, the shaft bucket was on its down stroke when the dook bucket was on its up stroke. This system periodically gave trouble, and all the other cranks were fitted up to work on tension, which was found to be the safest and most economical method.

It may also be stated that there was another direct acting pumping engine in No. 4 pit, made by Mr. Barclay, Kilmarnock. The diameter of the cylinder was 55 inches, stroke 10 feet, and diameter of the ram 22 inches. This engine and shaft fittings were also a good substantial fit up, and the pump has been pumping constantly night and day for over twenty years with good results.

In closing these notes I regret to say that I cannot state the amount of coal consumed for a given quantity of water pumped. There were so many engines all getting steam through the same pipes, that it was difficult to apportion to each its share of the coal consumed, and I am not aware of any diagrams being taken off this engine since it was erected in 1873. Diagrams should be taken off our winding, haulage, and pumping engines periodically. They are all the more necessary with engines of this description where there is a heavy weight of pumping rods, etc., to lift and lower at each stroke. The insuring of our steam boilers and their periodical inspection by competent officials specially trained for that purpose, has been productive of good results, both as to safety and economizing of fuel. Similar arrangements might be made for taking diagrams off our engines to keep us posted up as to their condition. Diagrams properly taken off would at once show under what conditions the engine is working, and the weight of the pump rods could be more nicely adjusted to the work required. I have not the least doubt that in a large number of our heavy fittings, where forcing rams and engines of this description are used, we are lifting and lowering at every stroke weights far in excess of what is required to force the water to the surface, thereby wasting more coal than is needed, and subjecting our machinery to greater tear and wear than is necessary.

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The Effect of Safety Lamps upon Eyesight.

It would appear from investigations made by a British scientist that safety lamps have a most injurious effect upon the eyesight of miners, being the chief if not the sole cause of nystagmus, night-blindness and photophobia. The great trouble arises from the nature of the shadow cast by the safety lamp, and it would seem that the great acme of perfection in a mine light is a light of greater effulgence and less shadow than that of the present lamps. So prevalent is blindness of various natures amongst miners who habitually use the safety lamp that considerable attention is now being paid to the matter, and the present investigations are therefore of considerable value. They were carried out in the Derbyshire collieries, a number of men working with mine and a number working with safety lamps being examined. It was found that out of 524 persons using safety lamps, there were 164 afflicted with nystagmus (which consists of a peculiar oscillation of the eyeballs), 127 had night-blindness and 61 photophobia. This clearly proves, Dr. Court states, that there is a serious amount of disease, and is in striking contrast with the disease found among the 573 miners using naked lights, of whom only 32 had nystagmus, one had photophobia and 12 night-blindness. This difference is made greater still when it is borne in mind that, out of these 32 cases of nystagmus, 29 of the men had previously used safety lamps, and the one man with photophobia and 11 of the cases of night-blindness had also been employed in mines worked with safety lamps. In other words, of the 544 men who had always used naked lights, there were only three who had nystagmus, and they worked with candles.

To illustrate Mr William Archibald's paper on PUMPING.

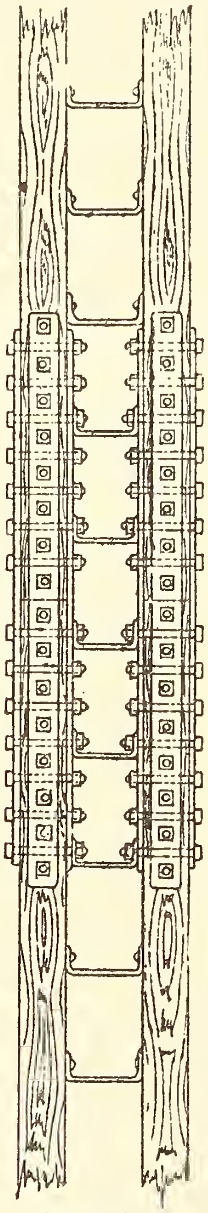

PLATE V VOL XIII
M I S

Scale 3/4" = 1 Ft.

To illustrate Mr William Archibald's paper on PUMPING.

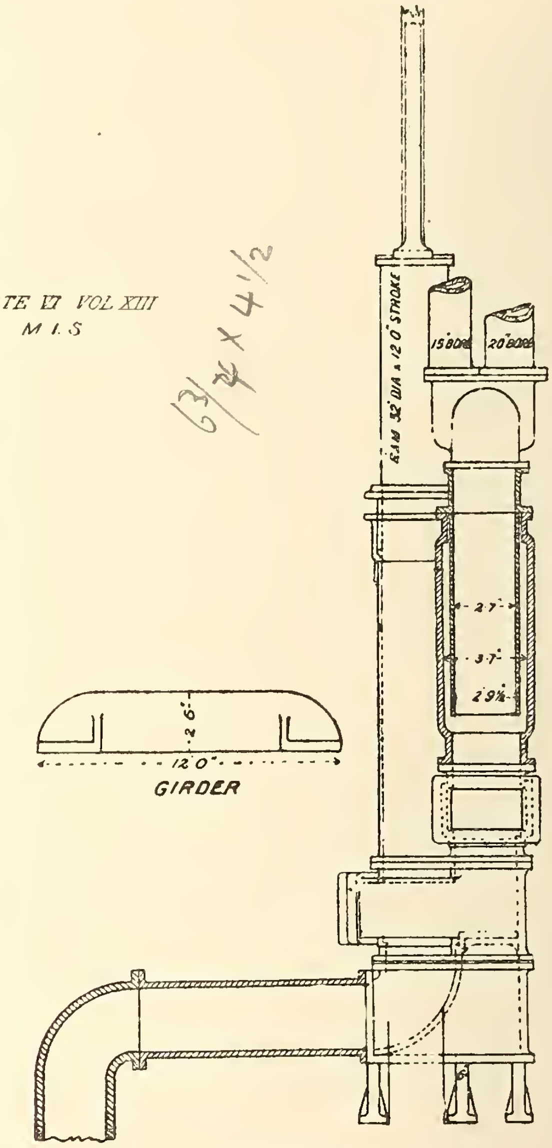

PLATE VI VOL XIII
M I. S

6 3/4 × 4 1/2

Scale 1/8"-1 Ft

The Ventilation of Mines.

A novel problem has been suggested by Mr. P. P, Quackenboss, a chemist of long standing, in a letter to an American contemporary, which has an important bearing upon the safe and more efficient working of mines, and particularly as regards their ventilation.

Mr. Quackenboss states that in view of the development of electricity in mining operations, it becomes necessary to provide a larger factor of safety in future methods than is at present possessed. He is of opinion that with all the precautions that engineering science has provided for mines, it is only by constant vigilance that destruction is avoided.

The first and most important subject is firedamp (CH_4), owing to instant effects. and the second is chokedamp (CO_2), which, though slower in its action, is equally deleterious. These gases are not confined to one spot, but by falls of roof in gangway or drift, or by miners' blasts in the rooms, they are liable to appear at any time and in all parts of the mines. Air-splits and brattices and all the known methods of controlling these gases fail at the critical moment. Mr. Quackenboss thinks, however, that if a more determined effort were made by those in authority to comprehend the nature of these gases, and to control their effects, the condition of mining property might be improved, the safety of the miners increased, and the profits largely augmented. It is for these reasons that the writer of the letter presents the following facts for the consideration of mining engineers :—

My first thought was that forcing hundreds of thousands of cubic feet of air into an air shaft to eliminate a few hundreds of feet of gas was a waste of power. Then again, it was being constantly polluted by mephitic gases during its journey through a mine from the natural exudation of "blowers" and "blasting." Then carburetted hydrogen as it makes its first appearance in a mine is a dry gas and is expansive and inflammable, but if it finds an excess of hydrogen present it becomes a saturated gas and explosive. Thus density and humidity add hydrogen in a finely sub-divided state, and it only needs a little agitation of the air and gas to prepare a big or little pyrotechnic display. The experiments shown by Thos. Shaw, M.E., with his celebrated inspector's mine gas testing machine have been of the greatest use to the miners and operators of to-day in demonstrating sub-divisions of gases, and in the hands of state inspectors will prove invaluable in the future. But of what use is it to know of dangers if they are not avoided in consequence of that knowledge? Therefore, if knowing the nature of CH_4 we see another element of danger about to be added to it, we need not wait for the damage to occur. The ordinary condition of a mine did not seem to present to my mind the excess of hydrogen spoken of above. so I sought for it in the air forced into the mine by the fan at the mouth ; then I saw at once that barometric change would produce the result if other conditions were right, and so taking a list of mine explosions to Serjeant Dunn, the signal service officer, at New York, and explaining my theory we took the record of temperature issued by the War Department, and selecting four cases, as follows, were surprised at the record :—

January 23, 1889, at Wilkes-Barre, explosion of mine gas. At that time the report shows a high pressure just passing off and a low pressure just approaching from the W.S.W.; barometer, 30.10. April 15, 1889, at Wilkes-Barre, explosion and precisely the same conditions. January 18, 1890, at Avondale, exactly the same conditions and result. June, 1890, the Hill Farm explosion at Dunbar, exactly the same conditions and result. We then started again with a list commencing with an explosion at Rich Hill, Mo., March 23, 1888, and again the high pressure was receding and low pressure approaching; barometer, 30.10 to 30.20. In all the cases from then down to January 1, 1891, the conditions are identical, and in each and every case the humidity was increasing so as to be marked plus. There we have the necessary conditions to create an explosion added to by a fan blower forcing a dense humid air down a mine like a gunner ramming home a charge in a gun. There is the death knell to the present system of ventilation, and the engineers will be forced to reverse their fans, and exhaust from their mines instead of forcing air in. Another point I wish to suggest is that as gas is lighter than ordinary air, it rises to the roof, and pipes of proper size and material would draw out the gas first. If proper openings and short pieces were put at suitable distances, with the necessary slides for closing those not in active use, the mine boss could start into a mine, and by opening and closing these vents would be able to eliminate all the gases collected in the galleries, air shafts or drifts before the men came in, and if falls of roof occurred during the night, damaging the pipe, it would not be very expensive to replace it on my plan. If this shall be carried out, I am led to believe that we can introduce the electric current into our mines with almost perfect safety.

The suggestion made by Mr. Quackenboss for minimising or obviating the explosions would imply a radical change in the present practice of mine ventilation. The idea that the forcing of dense humid air into the mines under certain atmospheric conditions, may add the element of hydrogen necessary to bring about an explosion is of great interest, and is borne out by the proofs brought forward in the letter.

To illustrate Mr. William Archibald's paper on PUMPING.

PLATE VII. VOL XIII

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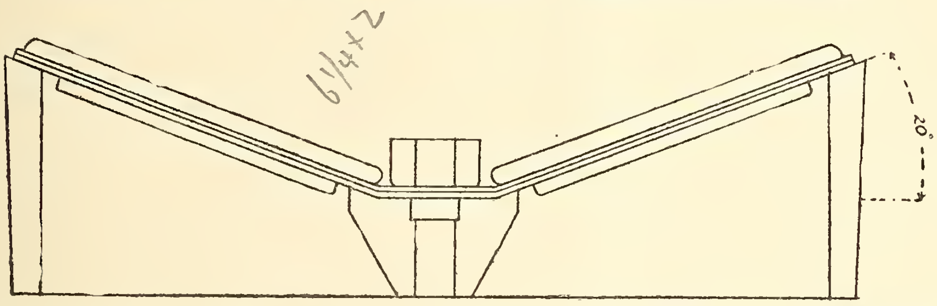

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Elimination of Manganese from Cast Steel.*

By M. L. Campredon, Metallurgical Chemist.

Manganese is a metal of relatively recent discovery. Scheele met with it in 1775 in certain manganesiferous ores, and Gahn separated it a few years later. In 1820, metallurgists found it in some varieties of pig. Berzélius, Karsten and Berthier were the first to study the combination of iron and manganese. We have to come down to 1862, the date of the truly practical application of the Bessemer process, to find a judicious and rational employment of manganese in metallurgical operations. Some years later, in studying the manufacture of steel in the Martin furnace with argillaceous sole, M. Vallon was led to present a theory of recarburation, and of the action of the manganese over the oxides of iron, which always contain the metal towards the close of the operation. Before the researches of M. Vallon, the quantity of manganese contained by specular pigs was not settled by chemical analysis, and according to the very happy expression of an eminent metallurgist, these products were bought by industrials according to their "good looks," and especially according to the dimensions of the facets presented by the pig. Manganese is now the most valuable auxiliary of the steel manufacturer in the best and most recent methods—converters and furnaces with acid, neutral or basic sole. Spiegel and ferro-manganese have become common and well-known re-agents.

Oxidation of Manganese.—In a general way, manganese is eliminated by preliminary oxidation. Manganese has always been considered as a very oxidisable element capable even of reducing other oxides, such as oxides of iron, by seizing upon their oxygen while the iron is set free. Metallurgists who formerly practised and studied the refining of manganesiferous pig never suspected that a certain proportion of manganese could remain in the steel or iron produced. Certain kinds of white pig, especially that from Luxembourg and Westphalia, were, however, held in repute for the production of steel. Was it because the manganese of these pigs prevented the oxidation of the carbon, or was it rather because manganese remained in the products obtained, that these pigs furnished steel with facility? An analysis of the steel obtained in this way would alone enable us to reply to this interrogation. In the puddling furnace the manganese is completely eliminated when the pig treated is not extra manganesiferous. In the acid and basic converters, as well as in the Martin-Siemens furnace with siliceous or acid sole, the manganese is equally oxidised, but with less completeness than the other elements of the charge, notably the carbon and silicium. In the basic converter, the manganese commences to become oxidised from the outset of the operation, and this action continues insensibly during the work, as will be seen by the following table, which presents the analysis of a series of tests taken at different moments of the operation, to follow the oxidation of the manganese :—

	Manganese. Per cent.
Pig charged	0·520
After 2 minutes' blast	0·430
" 4 " "	0·420
" 8 " "	0·300
" 9m. 15 sec. "	0·250
" 10m. 45 sec. "	0·190
" 11m. 45 sec. "	0·170
" 11m. 51 sec. "	0.120

It sometimes indeed happens, especially in the convertor or the acid-Martin furnace, that the almost complete elimination of the manganese presents some difficulties.

Working of the Basic Furnace.—In the basic furnace the presence of manganese plays a very important part. It must be remembered that in this metallurgical apparatus very active oxidations are produced during the whole course of the working, which would greatly injure the iron if the manganese by its presence did not abate this oxidation by acting as a moderator. It is necessary, therefore, especially when treating highly oxidized scrap iron, to calculate the charge in such a way that at least 0.500 per cent. of manganese is in the initial bath. This is done by forcing the proportion of manganesiferous pig, and in case of need by charging a suitable quantity of spiegel. A charge thus prepared works well; the oxides of iron act on the manganese and oxidize it, passing themselves into the state of metallic iron; thus is made manifest the reducing action which we have attributed to the manganese. Therefore, from the commencement of the operation, when the heat is sufficient, the manganese is oxidized, producing protoxide of manganese, which is incorporated with the slag, to which it communicates a very desirable fluidity. In a good working a complete fusion of the charge should be reached with a metallic bath still containing from 0.100 to 0.200 of manganese while the carbon is almost completely oxidized. In a series of three operations, starting it is true with only slightly manganesiferous pig M. Harbord reached complete fusion with the following quantities of manganese held :—

		Manganese. Per cent.
Experiment	No. 1	0.080
"	No. 2	0.100
"	No. 3	0.085

These quantities, indicated by M. Harbord in a paper entitled "Elimination of the Metalloids in the Basic Furnace," and presented to the Iron and Steel Institute in 1886, seem to us to be very near the hazardous limit. It is important to note, however, that the pig treated by M. Harbord was exceedingly phosphorous (containing more than 2 per cent. of phosphorous), so that this metalloid was capable up to a certain point of playing the part of preservative in place of manganese and preventing a too great oxidation of the iron. From the complete fusion up to the time of the final additions preceding the tapping of the cast metal, manganese plays a most efficacious part in the work. The final additions introduce into the furnace a notable proportion of manganese, which is employed in part in the reduction of the oxides of iron; the other part is incorporated with the metal, to which it communicates several very remarkable properties, as well in hot working as in its qualities in a cold state. The proportion of manganese which is incorporated thus with cast steel, is very variable. It is rarely, however, higher than 0.500 per cent. in a normal operation, and descends with difficulty below 0.100 per cent. We could attain to smaller proportions were it not that such a metal would stand a great risk of containing oxides dissolved, and it would be very difficult to run it off into good, sound ingots. Given an oxidized metallic bath, it is not very easy to estimate approximately the quantity of oxides which it contains: to bring it out a proportion of recarburates has to be added somewhat greater than would be necessary to work the reduction of the oxides supposed to exist in the bath from its general aspect and the course of the work, so that the metal always contains manganese. Moreover, had we the means of calculating exactly the proportion of oxides, and consequently the weight of the reducing agents, it would always be necessary to add a slight excess of the latter, so as to leave some traces of manganese in the metal, in order to reduce the oxides which are formed during the process of tapping.

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A New Electrical Company.—As will be observed in an advertisement elsewhere, a new company under the title of H. Ward Leonard & Co., has been formed in New York, to do business as electrical engineers generally, with special attention paid to electrical motor appliances, the transmission of power, the installation of central station lighting and power plants, the concealed wiring of large office buildings, hotels, etc., and plants in which advantages can be obtained by a combination of apparatus of various companies, such as alternating current systems, storage batteries, arc lights, etc. A feature of the business of this concern which is entirely novel, will be the supplying of expert information regarding engineering matters, the operation of different plants and upon the best methods and system of accounts in connection with the operation of electrical plants. Such information will be supplied by correspondence at a very moderate charge per annum. This Company will be actively in business before Sept. 1st. Their offices will be in the Electrical Exchange Building, Liberty street, New York city.

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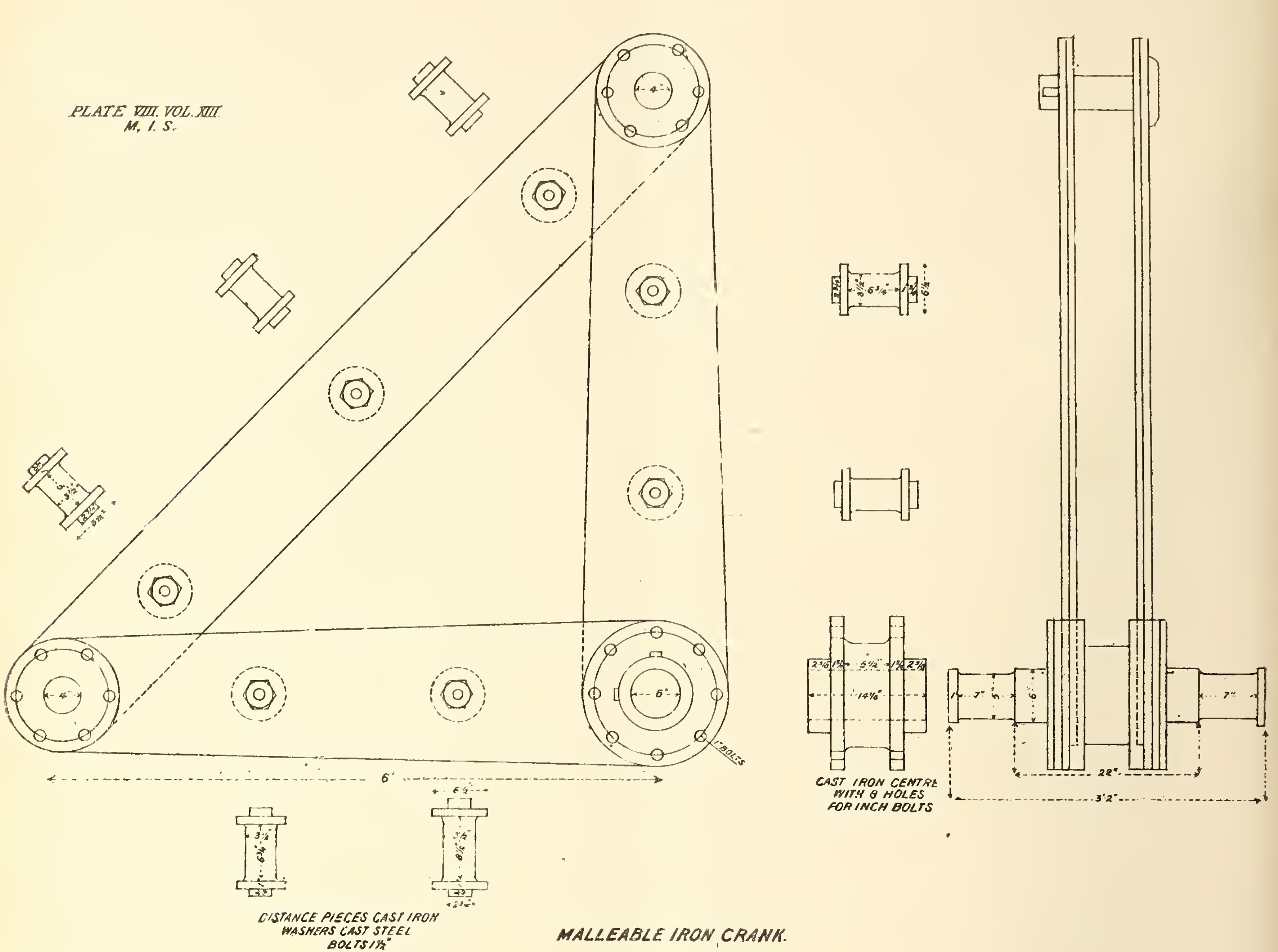
* Colliery Guardian.

To illustrate Mr. William Archibald's paper on PUMPING.



MALLEABLE IRON CRANK.
Scale 2½"=1 Foot.

The Refining of Sulphides obtained in the Lixiviation Process with Hyposulphite Solutions.*

By C. A. Stetefeldt, San Francisco, Cal.

Steam dried sulphides, obtained in the lixiviation process, are now almost exclusively sold to smelters, the old methods of melting (after roasting), in crucibles, or cupelling with lead at the mill, having become obsolete, principally because they involve accumulation of a large quantity of silver in by-products, that must be sold to smelters under any circumstances.

It would be desirable to refine sulphides at the mill by a humid process, especially when they contain a large percentage of copper, which would be converted into sulphate, the latter being used again in the mill for preparing Russell's extra solution. If refining is done by a humid process, it is hardly necessary to say the sulphides should be nearly free from lead and calcium,† and these metals, if present in the lixiviation solution in perceptible quantities, should be precipitated separately by Solvay soda.

The sulphides should also be free from soluble salts contained in the hyposulphite stock solution, since these salts cause serious difficulties in roasting and contaminate the copper sulphate obtained as a by product. Sulphide cakes from the filter press may hold 50 per cent. and more of moisture. If the sulphides are not washed before going to the filter press, or in the latter itself‡—which practice mostly prevails now—they may contain, after steam drying, a considerable quantity of sodium hyposulphite, sulphate and chloride, besides some other salts. While the percentage of sodium hyposulphite in the stock solution is kept constant, that of other salts increases to a certain limit, which may be very high. In one sample of Marsac sulphides, 11.3 per cent. of these salts was found, and in another, 13.2 per cent. Under all circumstances it is bad practice not to wash sulphides. Steam drying becomes more difficult and expensive, the salts retaining water of crystallization, and if sulphides are sold to smelters,§ freight and working charges have to be paid on worthless material. Besides, the sulphides may take up moisture during storage and shipment, thus causing disputes about discrepancies in weight and assay value.

The whole problem of refining sulphides at the mill presents financial as well as technical difficulties, *i.e.*, commercial success depends on the location of the works.

In one of my papers (*Trans.*, xiii., p. 105), I proposed to dissolve raw sulphides in concentrated, nitrated sulphuric acid, with regeneration of the escaping nitric oxide to nitrous and nitric acid, absorbing the latter by concentrated sulphuric acid. I am now of the opinion that this process is without merit. The principal advantage obtained for it was that roasting the sulphides, with loss of silver, might thus be avoided. But if steam dried sulphides are carefully roasted in a muffle furnace (the muffle being heated only from above, not from below), and the escaping gases are drawn through a Roessler convertor, the loss of silver by volatilization can be entirely precluded.

In my book, *The Lixiviation of Silver Ores with Hyposulphite Solutions*, I described a method essentially the same as that used by A. D. Hodges (*Trans.*, xiv., p. 731), for refining sulphurized, base Comstock bullion, with this difference, that in my plan the sulphuric acid for dissolving copper oxide was to be obtained as a by-product by drawing the sulphurous acid from the muffle furnace through a Roessler convertor. This method, which is only outlined in my book, I shall now consider more in detail. The principal difficulty of the process centres in the roasting. If sulphides are roasted as they come from the drying chamber, after grinding the lumps in a sampling mill, the resulting product is unsuited to treatment with dilute sulphuric acid. No matter how carefully the roasting is done, a granular mass is obtained, consisting largely of metallic alloys, with comparatively little copper oxide. It is not difficult to discover the reasons for this behavior.

1. In burning the free sulphur, the charge commences at once to form little balls.

2. The sulphides are not in the form of a copper silver matte, but consist of individual minute particles of the sulphides of silver and copper.

3. Silver predominates too much over copper.

4. Silver sulphide oxidizes too rapidly, and the copper oxide formed immediately reacts upon remaining sulphides, converting them into metals. Most likely, even at very low temperature, actual fusion of the very fine particles takes place, favoring the above reaction. By continued oxidation, a portion of the copper in the alloy could, no doubt, be converted into oxide, but the preponderance of silver would prevent oxidation to any depth. The same may be said concerning the action of the Roessler convertor. In the latter, metallic copper is readily dissolved by dilute sulphuric acid; but it is not probable that this would be the case with an alloy containing so much silver.

As already mentioned, lixiviation works now ship their product to smelters unroasted. Although, by roasting sulphides, their weight is materially lessened, and the product is obtained in a better and less bulky form for packing and shipping, the objection to roasted sulphides is based upon the difficulty, almost impossibility, of their correct sampling, making a fair settlement between buyer and seller a source of much annoyance.

All difficulties in roasting can, however, be overcome if we convert the sulphides into a matte, at the same time incorporating more copper, in the shape of cement copper, in order to obtain a product which permits a good Ziervogel roasting. There is more than enough free sulphur in the sulphides to sulphurize all the copper necessary for their purpose.

Hodges sulphurized base Comstock bullion easily and at a trifling expense in a cast-iron kettle. I see no reason why the matting and copperizing of sulphides could not be done just as well in the manner described by Hodges. He succeeded in roasting a copper silver matte, which contained on an average equal parts of copper and silver, converting as much as 75 per cent. of the silver (on an average, 60 per cent.), into silver sulphate. From the roasted product the copper was almost completely dissolved as oxide by chamber acid.¶ Most probably a

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[*] Transactions of the American Institute of Mining Engineers.

[†] Concerning calcium in sulphides, see my paper on 'The Precipitation of Metals from Hyposulphite Solutions," presented at this meeting.

[‡] Precipitations are washed easily, and with a minimum of water, in a filter press especially constructed for that purpose. In washing sulphides a very small quantity of Na_2S_2 should be added to the wash water to prevent sulphatization of Cu_2S.]

[§] The freight and smelting charges on Marsac sulphides are $30 per ton; hence, in not removing the soluble salts, from $3.39 to $3.96 are paid for shipping and reducing worthless material that might have been just as well left at the mill.

[¶] The bars produced from sulphurized so-called "white bullion" were on an average .967 fine in silver and gold.

copper-silver matte may be successfully roasted, even if silver predominates slightly over copper. But assuming that the relation of silver to copper must be one to one, the amount of copper needed would not be very large where ores are treated by the Russell process, and a comparatively large amount of copper comes to precipitation. All this copper would be returned as sulphate.

The operations of the process would be as follows:

1. Matting and copperizing the sulphides in a cast-iron kettle. Sulphurous acid, produced by burning of an excess of sulphur, should be conducted to the muffle furnace and thence to the Roessler convertor, or to the latter at once. The matte may be removed from the kettle while in a pasty condition, *i.e.*, before solidifying.

2. Pulverizing of the matte through a No. 40 screen.[*]

3. Roasting in a muffle furnace, with a Roessler convertor attached. The roasting should be conducted as was done by Hodges, *i.e.*, for the formation of a maximum of silver sulphate. Should the sulphuric acid produced in the convertor be insufficient for dissolving all the copper oxide, pyritic ores, containing silver, could be roasted occasionally, at slight expense, to make up the deficiency; or sulphur could be burnt should this prove more economical.

4. Boiling the roasted sulphides (after separating sintered lumps by screening), in a lead-lined tank with the sulphuric acid obtained in the Roessler convertor.

In this operation either of two methods may be selected. One, as described by Hodges, consists in the separate precipitation of the silver sulphate from the solution by copper, if it is desirable to raise the fineness of gold in the insoluble silver residue; the other, in effecting the decomposition of silver sulphate at once by placing copper plates in the dissolving tank. The latter method is the simpler, requiring less apparatus and manipulation, and deserves preference when gold is absent, or present in sufficient quantity to stamp the bars.[†]

5. Crystallizing the copper solution, if necessary, after concentration.

Since all or most of the copper sulphate is used again in the mill, and not for sale, special attention need not be paid to the production of a fine looking or very pure article. In fact, small crystals are more desirable for the preparation of extra solution than large ones. Mother liquor from the crystallizing vats would be returned to the Roessler convertor.

The concentration of solutions I propose to effect by running them through a lead tower, with inclined shelves, against a current of hot air. The latter would be drawn from the chimney of the muffle furnace by a Koerting steam jet ventilator.

6. Washing of the silver residues (and cement-silver); pressing into cakes; drying and melting into bars.

7. Precipitating cement-copper by scrap iron from wash waters, weak solutions and from mother liquors in which too much iron has accumulated.

In some cases a surplus of copper sulphate over that needed for extra solution in the mill may result. Where this could not be sold at a profit, it should be precipitated by scrap iron, thus keeping in rotation the cement-copper for copperizing the matte.

It will be seen that the process in this form presents no essential technical difficulties, all its operations being well understood by metallurgists; nor does it require large, expensive or complicated apparatus. The refinery should be built on a scale to remain in operation and keep the men employed continuously during the daytime only.

Whether it will be more profitable to refine sulphides at the mill or sell them to smelters, must be calculated for each individual case and depends entirely on local circumstances.

I have no doubt that refining sulphides at the mill would extract a higher percentage of the precious metals, especially of the gold, than is shown by the commercial assay upon which settlement is made between the buyer and seller. Smelting works must have a margin in their favor, or they could not conduct their business with a sufficient profit at the rates they charge for treatment and the percentage they deduct from the commercial assay value. Even the Freiberg works, belonging to the government, have their *Huettenremedien* and extract so-called "plus" silver.

Having in view the erection of a refinery for sulphides at the Marsac mill, Utah, I made the following laboratory experiments.

EXPERIMENTS WITH SULPHIDES CONTAINING LEAD AND CALCIUM.

(Sulphides Unwashed).

The lot of Marsac sulphides, a sample of which was at my disposal, was said to have been produced after the precipitation by Solvay soda of lead and calcium from the solution; but either the precipitation of these metals was not complete, or the sulphides had become mixed with those obtained prior to the introduction of separate precipitation for lead and calcium. The sample contained 34.7 per cent. silver (9.0 ounces gold per ton), 19 per cent. copper and 2 per cent. lead; calcium and other constituents not determined. A few grammes of these sulphides were digested with dilute hydrochloric acid. Carbonic acid and sulphuretted hydrogen were evolved, showing the presence of calcium carbonate[*] (and lead sulphide). The filtered solution was boiled with potassium chlorate, after which lead and a small amount of iron were precipitated by ammonia. From the filtrate a very perceptible precipitate of calcium oxalate was obtained. Most of the calcium however, remained, with the residue as sulphate.[†]

In roasting these sulphides in a clay dish in the muffle of a cupelling furnace the free sulphur was burnt quickly, and then a rapid roasting at a very low temperature took place. In elevating the temperature as required for a dead roast, the sodium sulphate (during roasting, sodium hyposulphite and chloride are also converted into sulphate), commenced to fuse, and the final result was a granular mass of brittle, metallic globules, on which continued roasting did not seem to have much effect. On treating them with sulphuric acid of 15° B., not a trace of silver sulphate was found in solution, and after continued boiling only a small quantity of copper was extracted.

Now, 50 grammes of sulphides were mixed with 8 grammes of cement-copper, to raise the percentage of copper to that of silver, and heated in a small cast iron crucible. Some sulphur fumes escaped, and then quick and complete fusion took place at a low red heat. The very liquid matte was poured out. Not a particle of metal had separated, and the inside of the cruicible was not visibly affected. The matte, pulverized and sifted through a No. 40 screen, was roasted at a temperature just sufficient to ignite it. It behaved very well and did not bake in the least just then. But when the temperature was raised, after the blue flame of sulphur had disappeared, the sodium sulphate commenced to fuse, and the roasting dish was filled with a mass like mush. Under still further increase of heat, the charge commenced to foam, through decomposition of sulphates and reaction between oxides and sulphides, and shortly after it hardened into solid, porous crusts. These were pulverized and boiled with dilute sulphuric acid. Rapid solution of the copper oxide took place, and from this solution copper sulphate and a great deal of sodium sulphate crystallized. The metallic residue was fused with borax, yielding silver .790 fine. It can be seen, as observed at the beginning of this paper, that roasting and treatment as above of unwashed sulphides is not practicable. Under such circumstances the roasting is not only very difficult and incomplete, but the resulting silver is too low in fineness and the copper solution is contaminated with sodium sulphate.

The sulphides were now leached with water, and the purified product was subjected to the same treatment as formerly.

EXPERIMENTS WITH SULPHIDES CONTAINING LEAD AND CALCIUM.

(Sulphides Washed).

The direct roasting of washed sulphides proceeded better than that above described; but when the temperature was raised the charge became rather sticky, foamed and then hardened. It contained considerable copper oxide; and, after boiling with sulphuric acid, the insoluble residue, melted with borax, yielded a button about half metal and half matte. The matte contained 35 per cent. of silver and the metal was .897 fine.

After matting and copperizing a sample, as described before, I found that roasting could be carried on without the slightest difficulty, the charge behaving well from beginning to end. I made no attempt at Ziervogel roasting, which is rather difficult anyhow with small samples, and with material containing so much lead and calcium. The temperature was quickly raised after most of the sulphur had been oxidized. At the end the charge was kept at a good red heat. After boiling with acid, the residue yielded a bar .938 fine in silver. With slower and more careful roasting, fine silver would, no doubt, have been produced, although the presence of lead and calcium sulphate must also have exerted an unfavorable influence.

EXPERIMENTS WITH SULPHIDES ENTIRELY FREE FROM LEAD AND CALCIUM.

Having, at the time, no sulphides free from lead and calcium at my disposal, I produced them by converting 10 grammes of silver into chloride, dissolving the latter in sodium hyposulphite solution and adding 40 grammes of $CuSO_4 + 5 aq = 10$ grammes Cu. The solution was precipitated with sodium sulphide and the sulphides were washed, dried and matted.

In roasting the pulverized matte great care was taken to regulate temperature so as to form a maximum of silver sulphate, especially by not allowing the charge to get too hot at the end of the roasting. This was accomplished remarkably well. In dissolving the roasted matte nearly all the silver went into solution and was precipitated as cement-silver. The final result was a bar .988 fine in silver.

EXPERIMENTS WITH SULPHIDES CONTAINING ONLY SMALL QUANTITIES OF LEAD AND CALCIUM.

(Sulphides Washed).

Finally, I obtained from the Marsac mill samples of a lot of sulphides containing only a trace of lead and much less calcium than the first lot.

The contents in silver were 34.6 per cent. (8.6 ounces gold per ton), and in copper, 20.0 per cent. Soluble salts, 13.2 per cent. After leaching out soluble salts, a part of these sulphides was matted directly and another part with incorporation of cement-copper, as described for former experiments. Both samples were now roasted with the intention of forming as much $Ag_2 SO_4$ as possible. Only a small portion of the silver, however, was converted into sulphate. This was evidently due to the presence of calcium in the matte.

The sample to which copper had not been added was rather difficult to roast, requiring constant stirring and showing a tendency to sinter, while the copperized matte behaved very well, as described in previous experiments. The addition of copper is of decided advantage in facilitating the roasting, and, in consequence, raising the fineness of the silver after solution of the copper. The matted and copperized sulphides yielded silver .990 fine, while the sulphides matted without addition of copper yielded silver only .938 fine.

The roasting in all these experiments was done in the muffle of a cupelling furnace which held clay dishes of only 3½ inches diameter. In consequence, the roasting of such small masses proceeded too rapidly, which was detrimental to the formation of silver sulphate, and favored the separation of metallic silver alloyed with more or less copper. There is no doubt that finer silver will result after careful roasting on a large scale. Sintered lumps, containing unroasted matte, should, of course, be separated by screening, and, after pulverizing, should be reroasted with the next charge. The presence of small quantities of lead and calcium is evidently not injurious, although it interferes with a good Ziervogel roasting.

This paper would have possessed more value and interest if the experiments had been followed by analysis of the materials and all the products. To do this I had neither the facilities nor the time; besides, such work is done more profitably at the mill, for reasons that require no explanation. I hope the muscular lixiviators will wake up to the fact that their work cannot prosper without analytical help. The present condition of affairs is disgraceful, as has been more fully shown in my paper on "Precipitation."

I refrain from giving estimates of the profit and loss in refining sulphides by the process described above, hoping to do this at some future time, after its introduction in practice.

The Transmission of Power by Electricity.—The *Bulletin de l'Electricite*, in a consideration of the problem of the transmission of power by high-tension currents, states that the official experiments demanded by the German Government from the Berlin General Electricity Company and the Œrliken Metallurgical Works as to their method of transmission of 300 horse power to a distance of 180 kilos. have given results full of useful information. The problem of the electrical transmission of power seems wholly solved by the employment of high tensions, before which the notion of distance between the generator and receiver disappears. It was necessary, however, to make some reservations as to the possibility of utilizing a current of 30,000 volts on account of the difficulty of suitably insulating the dynamos and conductors, besides which it was necessary to determine the conditions under which the disruptive charges took place. The Œrliken experiments do not definitively determine the question, their deviation being too limited. In the experiments under notice an alternating current dynamo giving at high pressure a tension of 100 volts communicated with the circuit of a large transformer wire plunged in oil, of which the circuit of the thin wire was joined on to the line. This, formed of bare wire of 4 mm., was supported by posts supplied with insulators and presenting a working length of 7 kiloms., and comes at the limits of the circuit from the thin wire of a transformer also steeped in oil, of which the thick wire circuit communicates with the receiver. In the first experiment the tension at the beginning of the line was 15,000 volts, and 100 volts only at the limits of the generator. In the two other experiments the tension of the principal current was pushed to 30,000 and then to 33,000 volts, the receiver only receiving a current of 100 volts. Carefully taken measures showed that the insulation was perfect, and that no deviation was produced either in the machinery or on the line. The result of this is that it is possible to produce and utilize without losses a current of 33,000 volts; but one cannot judge how long the insulants will resist, and the Frankfort experiments will enlighten us on this point. The dangers arising from a disruptive discharge are less to be feared than one would be tempted to suppose. Two thin wires had been fixed, one to each of the line wires, and their ends by degrees brought together; the discharge spark was only produced at a distance of 22 mm., under a difference of potential of 22,000 volts. The Helios Company have also made similar experiments and recognized that the spark burst at the respective distances of 28 and 64 mm. for tensions of 15,000 and 28,000 volts. Leaden circuit cutters being intercalated on the principal line, the formation of a short circuit was provoked, when the lead melted immediately and the current was interrupted. Such have been the Œrliken experiments, the consequences of which are of a kind to alter the present working conditions of electrical energy.

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[*] One cubic foot of matte, pulverized through a No. 40 screen, will weigh about 175 pounds.

[†] In connection with this point, I made the following experiment: An alloy of pure silver and copper, .500 fine in silver, was boiled with silver sulphate. Cement-silver was rapidly precipitated, although much more slowly than by the use of pure copper. I then took Ontario bullion, .440 fine, which is principally an alloy of silver and copper, and immersed a sheet of it in a silver sulphate solution. The reduction to cement-silver was very slow and ceased entirely after a short time. Probably the presence of a small amount of lead interfered with the reaction.

[*] Concerning the presence of calcium carbonate in sulphides, see my paper, "The Precipitation of Metals from Hyposulphite Solutions," already cited.

[†] It is not astonishing that so little calcium carbonate should be found in and dissolved from the unwashed sulphides. In digesting the sulphides with diluted hydrochloric acid, the sodium sulphate present precipitates most of the dissolved calcium as gypsum. In subjecting the sulphides to steam drying, there is also opportunity for converting calcium carbonate into sulphate. Gypsum as such cannot be precipitated by Na_2S_2 from a sodium hyposulphite solution (as constituted after use in the mill), containing calcium.

Concentration of Iron Ores.—Probabilities based on its Success.

BY J. BAWDEN, M.E., KINGSTON.

The business of crushing low grade magnetic ores and separating the mineral from intermixed rock by various magnetic adjustments has become an established industry in the United States. Some 26 mills are in operation, erected at cost ranging from $15,000 to $300,000. The plants engaged present features of no very distinctive type, and for each is claimed rival qualities of economy and efficiency, which will be determined ere long by extensive experience. The subject of concentration has won the attention of British iron-masters, to whom the proposal to render hematites magnetic by calcination, to be followed by the use of the magnetic separator, seems to commend itself as a practical method of enriching the furnace charge and thereby reducing the cost of fuel. These processes are of interest from their remarkable success in dephosphorization. They have shown conclusively that phosphorus accompanies the ore chiefly if not altogether in the form of apatite in the gangue, possibly as a phosphate of alumina in some ores. The increase of the sulphur content by the concentration process is its sole disadvantage, but it brings out the benefit of initial roasting, which also serves to facilitate the disintegration of some ores. The preparation of iron ores for the furnace is, in consequence of the attention directed to it by the success of the magnetic concentration process, likely to engage much immediate attention. To the furnace manager the subject is obviously commended, but to the mine owner it means the gift of value to properties which have after years of operation been put out of the market by mines offering richer ores, or which have never invited development by reason of low iron content. The first case put is that of several mines in New Jersey and New York, whose record has not supported the popular superstition that ores increase in richness in proportion to their depth. The extent of such property is probably not generally known. The State of New York alone has 14 anthracite, 1 coke, and 8 charcoal furnaces out of blast. There is no scarcity of iron ore, the output for 1888 having been 1,266,000 tons. It was only 4,000 tons less in the year 1879-80. A recent report on the iron mines of the state shows that 30 mines of magnetic ore, 8 of hematite, 11 of bog ore, and 3 of fossil ore are idle. One of the causes assigned for this state of things is the competition of richer mines, in which ore is won at less cost. Within 40 miles of New York the Peekskill mines occur at the southerly end of a range of magnetites, limonites and carbonates, extending 60 miles in length through Putnam, Dutchess and Columbia Counties. The success of large concentration works at the Tilly Foster mine attracts attention to the lean ores of this great iron range, and operations are in progress for the extension of concentrating enterprises. It is probable that ere long the importation of Spanish ores will receive a check from the competition of the product of New York and New Jersey concentration mills. The duty of 75 cents a ton has not interfered with the development of the Juragua mines in Cuba, the property of the Bethlehem Iron Company, from which the yearly output has reached 266,000 tons. Another large Cuban mine of rich magnetic ore is under development, and the extension of trade between Cuba and the United States consequent upon the recent reciprocity treaty with the Island is likely to help the mining interest. Over against the successes which the concentration process may win must be set the cheapness with which the hematites of the Southern States are mined, and notably the development of newly discovered mines of great extent in Virginia. This State is coming rapidly to the front as a producer of coal and iron, and there are features in her position which make it altogether probable that she will attain an industrial development which will soon secure for her the very front place in the Union. The recent extension of mine railways in the Pyrenees, and the introduction of machinery to aid the cheap labor of the Spanish mines, will afford American furnaces on the Atlantic coast another competitor to deal with for cheap ores of high quality. In fact the various sources for supply which have been traced leave no room for doubt that on the sea-board the American iron making interest is practically independent of the great ore producers of the North-Western States. While Chicago enjoys exceptional facilities for distribution along the path of western extension, it does seem that the south has more varied resources, a wider range of production, and a more hospitable sky than the western plains. The situation sketched indicates rather intense competition than that there shall be any friction which will hinder western progress. The Eastern States have had to follow the chariot wheels of a westward moving force, but the regenerated South moves on another line with new energies developing at every step of her progress. Is Canada likely to come in for any favors, or any degree of regard, that will help the development of her mineral interests, while new enterprises are not only absorbing American capital, but bidding lagerly for foreign syndicates and foreign shareholders? This question need encourage no pessimism, but the rather provoke energy and enterprise. Without these foreign capital will be of disadvantage rather than gain to us.

The report of the Ontario Inspector of Mines presents a recommendation which merits the consideration of the newly created Bureau of Mines. He says: "Several gentlemen largely interested in the development of the iron industry in Eastern Ontario have suggested that test borings throughout the principal ore occurrences in that district are a necessity to determine their extent and value. The *Iron Age*, the leading journal of the American iron trade, in commenting on the report of the Ontario Mining Commission, suggests that the quantity and quality of our eastern ores have not been demonstrated to the satisfaction of American investors. This opinion, though controverted, is still current with our American neighbors, and no answer so conclusive can be given as proper tests conducted by a competent expert in deep drilling in the magnetic deposits. The results, it is contended, would be invaluable to the investor as well as to science. Sir Richard Cartwright gave the following as his view on this matter: 'As far as I can form an opinion, I am inclined to believe that the very best thing the Government of Ontario could do would be to secure the services of a thoroughly competent Swedish mining engineer or iron-master, and get this gentleman to devote some months to the study of the mines of eastern Ontario. I think most of the Swedish iron furnaces work on charcoal and often with the assistance of water-power, and that the surrounding conditions found here more nearly resemble those existing in Sweden than anywhere else. The Government would then be in a position to decide whether they would grant any public funds to promote developments, or what other steps they would take.'"

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Phosphate Shipments from Montreal.

The following are the official returns of the quantities of Canadian phosphates shipped to Europe from the port of Montreal from July 21 to date:

DATE	NAME OF VESSEL.	DESTINATION.	SHIPPERS.	TONS.
J'ly 22	SS.Cynthiana.	Hull.	Lomer Rohr & Co.	60
27	" Gleniffer.	London.	"	270
27	" "	"	Millar & Co.	28
28	" City of Lincoln.	Liverpool.	Wilson & Green.	500
28	" " "	"	Lomer Rohr & Co.	120
29	Bark St. Julien.	Cardiff.	"	300
Aug. 1	Ship Mabel Taylor.	Liverpool.	Wilson & Green.	370
3	SS. Swedish Prince.	London.	Lomer Rohr & Co.	30
3	" " "	"	Millar & Co.	75
4	Bark Columbia.	Glasgow.	Lomer Rohr & Co.	80
6	SS. Fremona.	London.	"	187
10	" Princess.	Grimsby.	"	125
11	" Osmanli.	Liverpool.	Wilson & Green.	220
				2365

SHIPPERS' RECAPITULATION.

	Tons.
Lomer Rohr & Co.	1172
Wilson & Green	1090
Millar & Co.	103
Total shipments to date	2365

RECAPITULATION OF EXPORTS.

	Tons.
Liverpool	1210
London	590
Glasgow	80
Cardiff	300
Hull	60
Grimsby	125
Total tons exported	2365

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Phosphate Quotations.

Advices from London under date of August 12 are as follows:

"Our market here continues dull and lifeless, but with the advancing season we may hope to see a little more moving shortly. Meanwhile, however, there is no lack of supplies, and especially Floridas are offering liberally.

"From Liverpool the reports are of a similar tenor. We are advised that phosphates of good quality are too plentiful and difficult to sell. With firm offer of 80% they think business might be possible at 1*s.* delivered weights. 70% Floridas have, we are told, been sold at 9¼*d.* c.i.f., but on the other hand, still lower grades are rather scarcer, and 60% is quoted at 10½*d.* delivered weights.

"As regards Hamburg, we hear that Canadian 80% is being offered there at 12*d.* per unit, and that a sale has been actually made at that price, but it is reported the sellers had a special object in making the sale in order to depress the market to cover themselves for bear sales made some time ago."

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The American Sandstone Industry.—A bulletin issued by the Department of the Interior, Washington, in relation to the sandstone industry, says the amount of sandstone produced in the United States in 1889 was 71,571,054 cubic feet, valued at $10,816,057, while for 1880 the value was only $4,780,391, an increase during the decade of $6,035,666, or 126·26 per cent.

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The Jeffrey Manufacturing Co. of Columbus, Ohio, have in the hands of the printers, a revised Illustrated Catalogue and Price List showing all the chain links and specialties manufactured by them. A wrought chain is one of the latest additions to their already large list of chains. This Company have the largest line of chain links from which to select, of any manufacturer in the world and their list should be consulted by both the dealers and users of such machinery in general.

MINING NOTES.

[FROM OUR OWN CORRESPONDENTS.]

Nova Scotia.

Cariboo District.

The once productive Lake lode has been doing nothing for some time but pumping water, and authentic reports concerning the mine are lacking.

The Dixon property continues to produce largely, and from present appearances will maintain its out-put for some time to come.

The Halifax Mining and Prospecting Co. have ceased operations in this district, and the affairs of the company have been settled here by the manager, Mr. Edward Whidden.

Darrs Hill.

The management report a scarcity of labor, and a shortage of quartz on that account. The western stopes show a larger lode than usual, while the eastern stopes, though showing large bodies, are in low grade rock. The mill continues to give great satisfaction.

South Uniacke.

Reports from this district say Messrs. Thompson & Quirk are expecting bigger returns than usual, the quartz raised being of exceptional richness.

Work on the Nitherow property is reported satisfactory, the grade of the quartz being better than for some time.

No encouraging news is reported from the Neilly property, although the shaft is still sinking.

Waverley.

The lodes of quartz found near the Rutherford farm, about two miles from Waverley, have recently been tested with a reported result of $3 to the ton. The property has changed hands, and a small crew of men are at work prospecting and getting ready to open up the property. The lodes are near a good water power, and should be worked very cheaply.

The Lake View Co. closed down the 1st of August, the pumps, however, are still keeping out the water.

The Sophia Mining Co. have lowered the water in the Tudor lode sufficiently to commence stoping in the western end. No reports as to grade of rock have been received.

Renfrew.

The water in the Ophir lode is below the 250 ft. mark, and a strong lode eight inches thick is visible. This will be opened out next month. Considerable uncertainty exists as to the depth of the old workings, the greatest reported being 400 feet, but the present management think this figure too large.

The Free Claim remains closed down.

Gays River.

The Coldstream Co. have filled their ore bin with material coming from the new shaft, and started their mill on the 10th inst. It is proposed to drop the whole 50 stamps on this mill run.

Pictou.

The Explosives Committee, appointed by the Provincial Government, will meet at Stellarton, on Thursday, September 3rd. The members of the committee are, Mr. E. Gilpin, Inspector of Mines; Mr. H. S. Poole, of the Acadia Co'y; Mr. R. S. Brown, of the General Mining Association; Mr. H. Rae, Spring Hill; Mr. Thos. Johnston, Westville; and Mr. R. Crosby, of Cow Bay. The purpose for which they have been appointed is to ascertain which, if any, explosives may with safety be used in gaseous mines. Now that powder is prohibited in dusty or gaseous mines a safe and reliable substitute is required.

Cape Breton.

A party composed of President I. P. Gragg; Director M. F. Dickinson, jr.; G. G. Frances, M.E., of London; W. Ingalls, M.E., of the Mining and Engineering Journal; Pierre Humbert, jr., M.E.; H. O. Aldrich, of Cobb, Aldrich & Co.; G. F. Lord, of Lord & Mandell; Emerson Coleman, of New York; G. H. Newman, of Easthampton, and about a dozen other stockholders and friends of the Eastern Development Company, left Boston about the middle of the month for a two-day trip of inspection of the Coxheath Copper Mines and various points of interest in Cape Breton. They were much interested in examining these mines, and were unanimous in the opinion that Coxheath is destined to be a large producer with a profitable future. The party also visited the International coal mine, the town of Sydney, sailed on the Bras d'Or lake to Baddeck, took a drive in Big Baddeck Valley, and were handsomely entertained by Prof. Alex. Graham Bell at his beautiful country seat at "Beinn Bhregh," near Baddeck. The $350,000 of bonds necessary to erect concentration works, railway and smelting plant of a capacity to handle 200 tons of ore per day, will undoubtedly be immediately provided for, as a result of the actual values shown to exist at this mine.

Quebec.

Eastern Townships.

The regular monthly meeting of the Asbestos Club was held at Thetford mines on the 27th ult., when the large attendance of members justified whatever may have been said regarding the Club's earnest endeavor to make it a success. In the absence of the Thetford vice-president, Mr. A. Ward, Mr. D. A. Brown, of Boston, filled the chair in his usual graceful manner. The usual routine of business being through, the question of refurnishing and fitting of our new club room came before the meeting, when about one hundred dollars was placed upon the subscription list. We trust to have our new club house ready for the August meeting, the 27th inst. Mr. A. M. Evans, M.E., after all business had been transacted, then read a paper on the "Carboniferous Series." It was impossible in a limit of thirty minutes to enter into detail on such a large and interesting subject, and but the smallest "bird's-eye view" could be given of the matter. It was observed that he took the "peat bog theory" regarding the formation of our vast deposit of black diamonds. A vote of thanks was unanimously tendered to him for paper read. On our opening meeting (new club house), we expect to hear a lecture from the Government mining engineer, Mr. J. Obalski, of Quebec.

The all absorbing question is the mining tax among mining men in this district, the Quebec government having sent in the papers for us to fill up *to be taxed on*, and we all simply say we cannot fill them up for the simple reason we honestly believe said tax in said form simply to be monstrous and unjust to every miner in the Province of Quebec. It is not because mine owners or mine managers wish to evade any fair and legitimate tax, but the way in which the tax is taxed is very far from proving that the men who proposed such taxation know the first principles connected with mining enterprises as a whole and in general. If we must be taxed, why, in heavens name! don't they tax us on profits, not on loss?

Our visiting friends from New York and New Jersey, having taken pity upon our being burnt out, in connection with local talent, propose to give a grand concert for the benefit of our Asbestos Club at an early date. We trust its success will be commensurate to the worthy object it aims to assist.

Lievres River.

A number of the principal phosphate companies on the Lievres River addressed a letter to the Minister of Public Works, setting forth the injury that would be done by closing the navigation at Little Rapids in the following terms:—"That we are under engagements to deliver large quantities of mineral which can only be forwarded for shipment by way of the River du Lievre: that if navigation be stopped at this season of the year, the result will be most disastrous to our interests, and that the time for closing the River at Little Rapids, as stated in the above mentioned communication, namely, the 10th proximo, is an unusually short notice. In view of the above, we have to beg that you will cause immediate enquiry to be made into the matter, as to whether the work of constructing a dam at Little Rapids could not be effected during the winter, after the shipping season has closed." This was signed by Messrs. Wilson & Green; J. Lainson Wills, for the General Phosphate Corporation; O. M. Harris, for the Canadian Phosphate Co.; Lomer, Rohr & Co.; and the Anglo-Canadian Phosphate Co. A verbal reply was received from the Department to the effect that it had been decided not to close navigation, but to do the work during the winter or in early spring.

Mr. L. J. Langmead, secretary of the General Phosphate Corporation, is out, going into the general work and accounts for the Fall meeting.

At the Corporation's mines work goes steadily on. On the 8th inst. a scow sank in going through the Long Rapids, with 40 tons of phosphate, which will be recovered.

Mr. E. Watts has left for British Columbia where he will prospect for copper and silver in the Kootenai District for an Ottawa syndicate.

The High Rock property is doing exceedingly well under the new superintendent, Mr. Twidell, the output being steady and of good quality.

Templeton District.

The General Phosphate Corporation have taken out this month about 80 tons of first quality ore from the Murphy lot in the 7th range. 45 men are constantly employed.

Mr. Louis McLaurin has sold his high grade ore to Lomer, Rohr & Co. at Montreal.

The Templeton Asbestos Co. are vigorously pushing their prospecting drifts and are sinking the main shaft to a depth of 100 or 125 ft., and it is their intention to run drifts from that depth into the side of the mountain. 50 men are employed.

Mr. Lederoux left last week for Paris. He goes via Florida where he intends spending some weeks visiting the phosphate workings there. He has concluded not to operate his asbestos claims in the District of Templeton.

The Netherland Co.'s out-put from their two leading pits will be slightly in excess of July. About 40 men and 3 teams are employed.

During the past four weeks McRae & Co.'s out-put from the "Loyalty" mine, with 10 men, has been about 30 tons of firsts and 20 tons seconds. The old disputed show adjoining the Blackburn property is turning out very good at depth. From their property on 11 in the 5th range about 100 tons have been taken out this month.

Messrs. W. M. Schlaesinger, mining expert, and Frank Thomiar, expert driller, from New York, representing the Edison General Electric Co., are installing the electric plant at McRae & Co.'s mine on 11 in the 5th range. The drill was started a few days ago but owing to lack of power a larger engine has to be put in, in order to get desired results from the drill and hoist.

The out-put of the Blackburn mine this month will be in the vicinity of 500 to 600 tons. 100 men and 10 teams are employed.

The McLaurin Phosphate Syndicate's phosphate drawn last winter to the dump on the Blanche is now being transferred to the river front for transhipment to Montreal.

Messrs. McVeity & Kidd have some 14 men engaged in opening up a mica show on the west half of 10 in the 7th, back of Perkins' Village.

Ontario.

Portland Township.

First shipment of asbestos from Mr. Allan's mines has been made, consisting of 67 bags, of various grades, the sale price of which will determine the future workings.

The old French property is being opened up again. Some good surface shows have been recently stripped which promise well for paying work.

The Fleming Phosphate Company's mine, in 4th Range, has been inspected by a competent mining engineer who has pronounced it one of the most remarkable phosphate deposits in Canada. One thousand tons of high grade ore will be taken out in development and shipped the coming winter.

Perth District.

Mr. Edward Watts has just returned from an exploring expedition to the Island of Newfoundland. Two years of diligent search and laborious work by Mr. Watts and his party failed to lead to the discovery of any economic minerals.

Wakefield.

Mr. T. J. Watters has some 40 men working day and night on his mica property recently purchased from Messrs Skead & McVeity. This mine is doing better than ever. Production about 30 tons rough per week. Cutting plant will shortly be put in.

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Our line comprises Explosives, Fuse, American and English Mill and Hammer Steel, Bar and Bolt Iron, Steel Wire Hoisting Rope, Hemp and Manilla Rope, Rubber and Leather Belting, Miners' Candles, Oils and Lamps, Miners' Tools, Machinists' Tools, Blacksmiths' Tools, and every requisite for the gold miner.

H. H. FULLER & CO.,
Halifax, N.S.

Masham.

Mr. A F. MacIntyre's lots, 4, 5, 6, & 7 in the 2nd Range of Masham, recently purchased, are opening up well. Some ten or eleven men under John Holmes have been stripping for the past two months. Four distinct leads occur on 5, 6, & 7. As these lots are less then a mile from LaPiche Station G.V.R.R., the property will be handy to work.

Port Arthur.

A car load of ore was shipped from the Badger-Porcupine mines recently.

At Arrow Lake work has been suspended on the Winchell Middaugh on account of water. The main shaft is down over 50 feet, and good fair ore has been obtained right along.

At the Augusta mine there is a force of twelve men now at work. The drift has been driven in to a distance of 49 feet beyond the surface showing, at a depth of over 160 feet, and on the 1st of this month it was estimated that they were about 19 feet from the vein.

British Columbia.

Kootenai District.

In the Silver King the tunnel has been advanced about 70 feet beyond the old cross-cut and the shaft in the tunnel is down about the same distance. The tunnel is run straight, regardless of the course of the ledge, and the shaft has cut the foot-wall of the ore body in which it was commenced. $1,300,000 has been offered for this mine, and refused. At present 21 men are at work, but the force will probably be largely increased in the near future.

The summit of Toad Mountain is beginning to show up like a mining camp, now that development work is being done on half a dozen contiguous claims. On the Grizzly Bear men are at work building quarters and making a face for a tunnel. Superintendent Robertson says he has the finest tunnel site in the district, and on a ledge too that is fully 30 feet in width. A road will be built from the mine to the main road, a distance of 2½ miles through a good country and by an easy grade. The distance from Nelson will be less than six miles.

A claim known as the Tam O'Shanter on the east side of Kootenai Lake, not far from the Blue Bell, is attracting considerable attention because of the size of the body of ore in sight, much of which runs and is of a free milling character. An average specimen selected from the lump assayed $62 in silver to the ton. The claim is bonded to Montreal parties.

That A. M. Esler made no mistake when he purchased the Dandy is being proved by the development work. The tunnel that was started within a few feet of the west end of the ground is in 35 feet, and in ore—the ore being copper pyrites and grey copper. This proves that the ledge is continuous the full length of the claim. A road is now being made to connect the mine with the main road, a mile distant. By the time it is finished a sawmill will be on the ground, one being on the way in. This means that the owners of the Dandy are in earnest, and that by fall the claim will be fully equipped with not only mining, but reduction machinery. The pay roll now carries 21 men.

The Crescent, a claim owned by a Spokane company, has over 8 feet of solid galena ore in the bottom of its shaft, which is down 50 feet. The showing, along with the showing in the lower tunnel of the Fourth, makes claim owners in Hot Springs district feel jubilant. A correspondent at Ainsworth writes: "To-day, at the Fourth, with one man picking and one sacking, the product was 10 sacks of high grade ore. Superintendent Trewarthen is excited."

The Dandy Company, in stripping the ledge above the lower tunnel on the Dandy recently, uncovered a body of fine looking ore, which gives higher returns than that from the surface on the upper end of the claim. The road has been swamped and the stumps blown out, so that machinery can now be got on the ground. At the Grizzly Bear, the tunnel face is under cover, charcoal is being burned, and the boarding house is almost completed. On the Vineta Boy, Ben Thomas, Charles Malley and John Conners are sinking the shaft, now down about 30 feet, 50 feet further. At the Cumberland, a claim recently discovered by Harry Ward, Charles Dundee and A. R. Seaman, a shaft is down several feet in ore that shows grey and peacock copper. The ledge is reported to be fully six feet in width and apparently in place.

The manager of the Kootenai Bonanza Mining Company advertises for tenders for from 250 to 500 feet of tunneling on the Silver King, which means that the own-

Write to us for 20 Page Circular on Latest Improvement in Canadian Rock Excavating Machinery, Manufactured by THE INGERSOLL ROCK DRILL COMPANY, LTD., 203 St. James Street, Montreal. See General Advertisement on Back Cover.

ers of that property want to know what they really have before they accept any of the offers made for it. The waggon road is completed to within a short distance of the summit of the mountain, and will be at the Silver King very shortly. About 60 men, besides those on the waggon road, are working for wages on the several claims on Toad mountain. The only sale reported lately was the Lulu, a claim adjoining the Silver King on the north, to E. Ramsay, manager of the Kootenai Bonanza Company.

Ore is being hauled from the Number One mine to the landing at Ainsworth for shipment to the smelter at Revelstoke. Over 200 tons are now sacked, and the contractors expect to haul from six to ten tons a day. The mine continues to look away up, as does the Fourth in the same camp.

The owners of the fraction between the Blue Bell and the Kootenai Chief claim they have more solid ore on the surface than is on either of the big end claims for the same distance. Alec McLeod, Tom McGovern, George Francis, Jack McGinnis, and Dennis Devlin are the owners.

Vancouver Island.

The electrical coal cutters at the Union mines at Comox are giving great satisfaction, and more than fulfilling expectations. The shipments are steady and increasing. It is understood that the company intend increasing their rolling stock to 250 cars, each of a capacity of 25 tons.

An explosion occurred on July 25 in No. 2 shaft of the East Wellington colliery, by which three men were seriously injured. It appeared that one of them had gone into an old and unused air way with a naked light which attracted a quantity of gas which had accumulated there since the test of the previous week. Two men were burned some time ago in this very spot, and it had been since barred off from the main level. No damage was done to the mine, nor were any stoppings, curtains, or doors blown out.

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CANADIAN COMPANIES.

The Silver Wolverine Company, (Ltd.)—Under a winding-up order made against this company on June 6th last, the secretary has submitted a statement which shows, as regards contributions, a deficiency of £68,156, and, as regards creditors, an estimated surplus of £208, subject to cost of liquidation. The Official Receiver (Mr. C. J. Stewart) states that the company was registered on October 19th, 1888, and was formed for the purpose of acquiring and developing the Wolverine silver mine, situate in the Province of Ontario. By an agreement dated January 21st, 1889, the company acquired the property from Mr. H. E. Winter, (one of the promoters of the company), the purchase price being fixed at £60,000 payable as to £1,230 in cash, and as to the balance in fully paid-up shares. The property was reported upon by mining experts and others, whose reports and assays were referred to in the prospectus issued by the company. The company commenced operations at the mines in January, 1889. Trial shafts were sunk, and the development of the property proceeded with until May, 1890, when the company appears to have fallen short of working capital, owing, it is alleged, to the nonpayment of calls in arrear to a heavy amount, and instructions were sent to Canada to shut down the mine by the end of that month. The mine superintendent, it is stated, did not quit the property until August, 1890, but prior to that date judgment creditors in Canada (who are, for want of any information on the subject, returned in the statement amongst the unsecured creditors) seized and disposed of all the plant and machinery at the mines. The insolvency of the company is attributed by the secretary to insufficiency of working capital, and to operations at the mines, so far as continued, proving unremunerative.

The Hixon Creek Hydraulic Company, (Ltd.)—Application will be made for incorporation under the British Columbia Act of the above company, for the purpose of hydraulic or other processes of mining; to own and construct ditches, flumes and other systems of water ways; to purchase, own, and work mines and minerals; to erect plant to treat same; with other powers. Head office, Quesnellemouth, B.C. Capital stock, $100,000, in 100,000 shares of $1 each. Applicants, James Reid, T. R. McInnes and J. Wilson.

The Canadian Super-Phosphate Manufacturing Company (Ltd.)—We hear that a company under the above title will he brought out in London some time in October, with a capital of £250,000, divided into 49,700 ordinary shares of £5 each, and 150 Founders' shares of £10 each. It is intended to manufacture super-phosphates and other fertilizers, and to this end the North Star mine and several adjoining properties are to be taken up, and also the grinding mills at Buckingham Basin, on the Lievres River, while contracts will be made for a supply o sulphuric acid. The enterprise is based upon the studies and reports of Prof. Francis Wyatt, Ph. D., of New York, and the phosphate properties have been examined and favorably reported upon by Mr. George Atwood, C.E., M.E., of London, Ont. Regarding directors, the London ones have not yet been appointed, but the proposed Canadian advisory board will comprise the following names: W. H. Nicholls, Capelton, P.Q.; Hon. M. H. Cochrane, Alberta, N.W.T.; Hon. C. C. Colby, Hon. Peter MacLaren, Perth, and F. S. Shirley, New Bedford, Mass.

The Straight Lake Mining Company, (Ltd.)—This company will make application for incorporation under Ontario laws, for the purpose of carrying on mining works and operations in the District of Algoma, in the vicinity of Straight Lake and elsewhere in the province; to deal in mines, mining claims and minerals; to mine, smelt, treat, mill and refine nickel and associated ores, with other customary powers. Head office, Toronto. Capital stock, $1,000,000 in 200,000 shares of $5 each. Applicants, D. G. Gordon, J. Howard, O. M. Arnold, H. Vigeon, and A. Gordon, all of Toronto; of whom D. G. Gordon, O. M. Arnold and H. Vigeon are to be the first directors.

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Latest Stock Quotations of Canadian Companies in England.

	Price.	
Excelsior Copper, Limited, £410,738 fully-paid shares of £1	—	
Nicola, Limited, £35,000 fully-paid shares of £1	—	
Shuniah Weachu, Limited, £99,888 fully-paid shares of £1	—	
Silver Wolverine, Limited, £68,465 fully-paid shares of £1	—	
Tilt Cove Copper, Limited, £160,000 fully-paid shares of £2.	—	
Ditto, £80,000 5½ per cent. debentures...	—	
General Mining, Limited, £219,752 fully-paid shares of £8	3¾	4¼
Low Point, Barrasois and Lingan, £509,100 fully-paid shares of £100.............	—	
New Vancouver Coal Mining and Land, Limited, £185,000 fully-paid shares of £1	⅝	⅞
North-Western Coal and Navigation, Limited, £160,500 6 per cent. debenture coupons, June 30 and December 31; principal 1904	—	
Ditto, £149,500 fully-paid ordinary shares of £10	—	
Ditto, £900 fully-paid deferred shares of £100..........................	—	
Sydney and Louisburg Coal and Railway, Limited, £50,000 cumulative 10 per cent. first preference shares of £10, £6 paid ..	7½	8½
Ditto, £14,560 fully-paid non-cumulative 6 per cent. second preference of £10......	3	5
Ditto, £250,000 fully-paid ordinary shares of £10............	¼	¾
Anglo-Canadian Asbestos, Limited, £11,500 fully-paid shares of £1	—	
Anglo-Canadian Phosphate, Limited, £46,510 fully-paid preference shares of £10......	—	
Ditto, £25,000 fully-paid deferred shares of £10..............................	—	
White's Asbestos, Limited, £20,000 fully-paid shares of £1	—	
Ditto, £15,000 shares of £1, with 15s. paid	—	
Canadian Phosphate, Limited, £100,000 fully-paid shares of £1	—	
Bell's Asbestos, Limited. £140,000 fully-paid shares of £5..........................	8⅜	8⅝
Ditto, £68,400 debentures, 5 per cent.; interest January 1 and July 1	—	
General Phosphate, Limited, 5 per cent. ordinary shares of £10, £2 paid...........	—	
Ditto, £5,000 fully-paid founders' shares of £10................................	—	
Western of Canada Oil, Limited, £200,000 fully-paid shares of £100.............	—	
Ditto, £99,850 fully-paid shares of £50 . . .	—	
Western of Canada Oil, Limited, £199,700 12 per cent. debentures of £100........	—	

Excelsior Copper.—Registered Septemher 26, 1888. Accounts to December 31 submitted in April. No dividend yet. Liquidation and reconstruction have been decided upon.

Nicola.—Accounts to December 30 submitted in November. No dividend yet.

Shuniah Weachu.—Accounts to November 20 submitted in February. No dividend yet. Shares for £12,870 held by the Company.

Silver Wolverine.—Registered October 19, 1888. No report of meeting received yet.

Tilt Cove.—In March, 1890, the properties were leased for 99 years to the Cape Copper Company, Limited, at a rent of £4,400. The Cape Copper Company advance £15,000 at 5 per cent. interest, and when this is repaid out of profits; surplus profits are to be divided equally between the Cape Copper Company and the Tilt Cove Company. The lease may be determined by the Cape Copper Company at any time on twelve months' notice. Accounts annually to March 31 submitted in November.

General Mining.—Accounts to December 31 submitted in April, but an interim meeting is held in November. Dividend for 1884, 5 per cent.; for 1885 and 1886, 3½ each year; for 1887, £4 13s. 9d. per cent., and for 1888 and 1889, 3¾. Reserve fund, £29,850.

Low Point.—Accounts to Decemher 31. For 1887, 1888, and 1889, 5 per cent was paid each year on the ordinary shares publicly held; for 1888 the ordinary shares issued to the vendors got 3½ per cent., and for 1889, 2½.

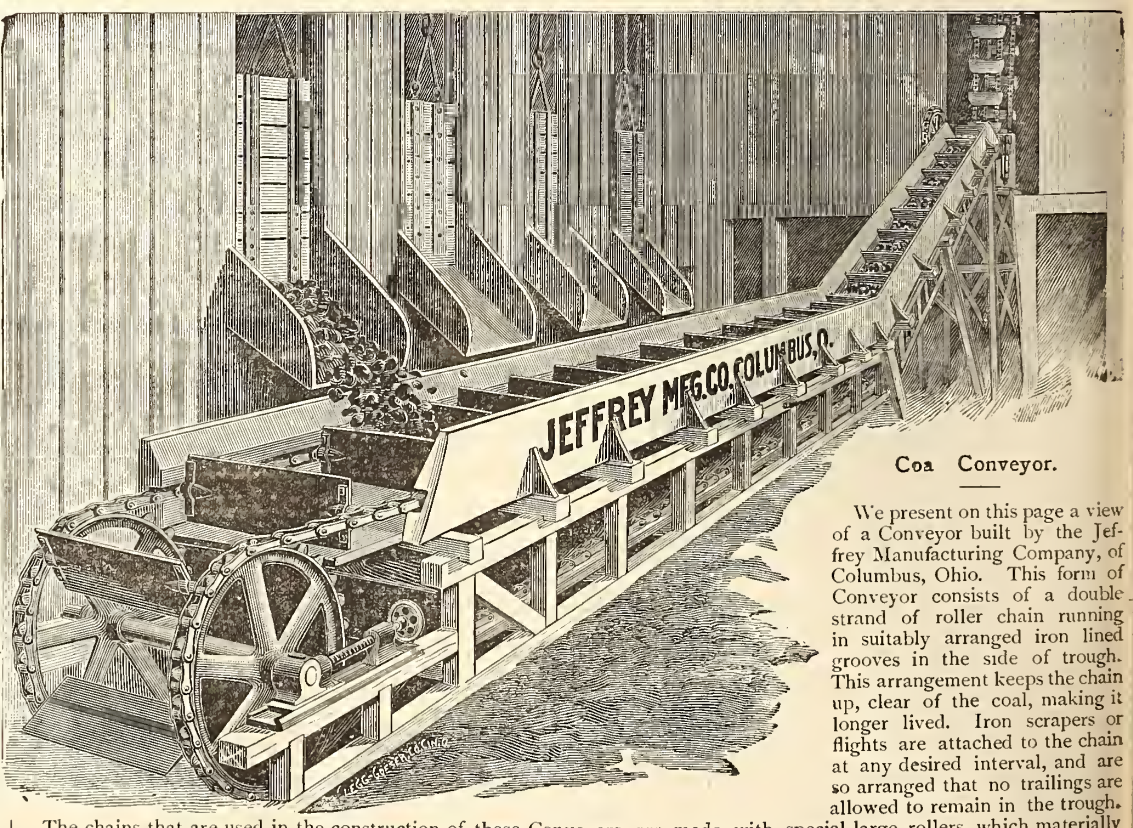
New Vancouver Coal.—Reconstructed in 1889. Accounts to June 30 and December 31 submitted in November and May. For the two half-years to June, 1889, 5 per cent. per annum was paid, and for the two half-years to June, 1890, 4. Debentures, £60,000.

North-Western Coal.—The deferred shares receive no dividend until 15 per cent. per annum (cumulative) has been paid on the ordinary. Accounts to June 30. Dividend for 1887-8 and 1888-9, 5 per cent. per annum.

Sydney and Louisburg Coal.—Accounts to December 31 submitted about May. In respect of 1889 15 per cent. was paid on the first preference, leaving arrears of 50 per cent.

Anglo-Canadian Asbestos.—Reconstructed in 1889. At general meeting held on 16th April, a dividend at the rate of 20% per annum was declared.

Anglo-Canadian Phosphate.—The preference shares rank first for 7 per cent., and after a like rate has been paid on the deferred shares, both classes rank equally. Accounts to November 30, submitted in May. No dividend yet on either class. Debit to profit and loss on November 30, 1889, £4,784. One of the mines has recently been sold and another leased.


JEFFREY MFG.CO. COLUMBUS, O.

Coa Conveyor.

We present on this page a view of a Conveyor built by the Jeffrey Manufacturing Company, of Columbus, Ohio. This form of Conveyor consists of a double strand of roller chain running in suitably arranged iron lined grooves in the side of trough. This arrangement keeps the chain up, clear of the coal, making it longer lived. Iron scrapers or flights are attached to the chain at any desired interval, and are so arranged that no trailings are allowed to remain in the trough. The chains that are used in the construction of these Conveyors, are made with special, large rollers, which materially lessen the power required to drive them, as each link acts as a truck, when running in the iron lined grooves. Coal may be taken into the Conveyor at any point along the line, and may be discharged in like manner, by simply removing suitably arranged slides in the bottom of the trough. For further particulars address manufacturers as above.

NEW CONCENTRATING MACHINERY

FOR A COMPLETE PLANT, HAVING A CAPACITY OF 50 TO 75 TONS.

We have at Mattawa, Canada, in warehouse, for immediate delivery, the following: New Blake Crusher, Cornish Rollers, and Concentrating Machinery, to form a very complete concentrating plant for low grades of Argentiferous Galena, Copper, or any kind of concentrating ore, and has a capacity of 50 to 75 tons in 24 hours. The machinery is extra heavy and of best material. Will furnish parties purchasing this plant working plans, &c. A 35 to 40 horse power engine will be sufficient as motor.

This machinery includes the following:

One 9 x 15-inch Blake Crusher complete.
Two sets 22 x 14-inch Cornish Crushing Rolls, all complete.
Two Revolving Screens, 4 sections each, all complete.
One Classifier all complete.
Four Double Jig Machines, 8 sieves each, all complete.
One Rotary Table (iron parts only) all complete.
Two Elevators 12 inches wide, all complete.
All Shafting, Pulleys, Couplings, Bearings and Collars, with all necessary Belting for above machinery, as per plans.

This invoice of machinery is all new, and has never been erected, and was ordered as a duplicate of a similar plant we furnished and erected for a company who operated very successfully in Northern Canada, but on account of the scarcity of ore, do not now require the duplicate plant, and we can offer it to any one requiring a first-class concentrating plant of this capacity at a great bargain. We can also furnish a competent man to erect and operate same if desired.

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We will do no manufacturing and will do no supply business; neither will we under any circumstances act as the selling agents of any concern directly or indirectly.

We will, however, act for the purchaser either as Consulting Engineers, Supervising Engineers, Inspectors or Purchasing Agents. When acting in this way we will make the following charges based upon contract prices:

For making preliminary plans, designs, distributions and estimates, 1 per cent.

For making final plans and specifications, 1 per cent.

For drawing and executing contract on behalf of the purchaser, 1 per cent.

For supervising an installation made by another contractor, 3 per cent.

For acting on behalf of the purchaser in making the settlement with another contractor, 1 per cent.

For acting as the agent of the purchaser, from the beginning to the final settlement of the contract, including the making of estimate plans, determinations, specifications, contract, supervising the installation, final inspection, and report and final settlement, 5 per cent.

It will be seen from the complete schedule given above that the purchaser will be able to obtain our services for any portion of the work, and under terms which are so reasonable that there can be no question, in the minds of those familiar with the subject, that any purchaser contemplating the installation of an electric plant would not only save a great deal of his own time and be spared a great deal of annoyance, but would actually effect a very material saving in retaining our services to represent the interest of the purchaser.

For descriptive pamphlet address

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A SPECIAL ANNOUNCEMENT OF THE

FACULTY OF APPLIED SCIENCE

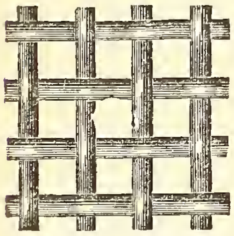
has been prepared, stating the details of the new Chairs, Laboratories, Workshops, Apparatus, and other improvements in its several Departments of

Civil, Mining, Mechanical, and Electrical Engineering and Practical Chemistry,

which will afford in the session of 1891-2 advantages not hitherto accessible to Students in this country.

Copies may be had on application to the undersigned, who can also supply detailed announcements of the other Faculties of the University, viz.:—Law, Medicine, Arts (including the Donalda Course for Women), and Veterinary Science.

J. W. BRAKENBRIDGE, B.C.L.,
Acting Secretary.



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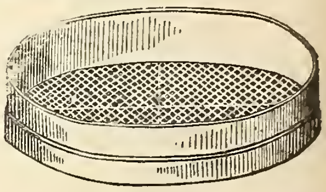

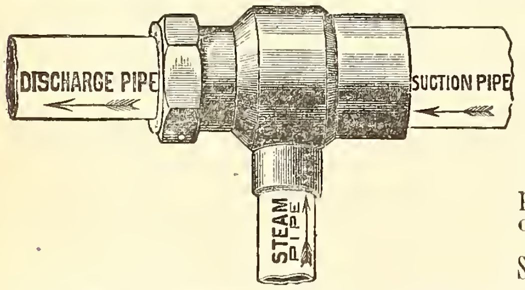

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SAVES YOU BUYING A $500.00 PUMP.

For the following uses:
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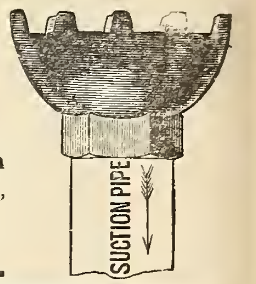
Send for Catalogue and Price List. **GARTH & CO., MONTREAL.**



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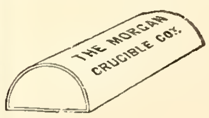
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This Company will arrange to connect places not having telegraphic facilities with the nearest telegraph office, or it will build private lines for firms or individuals, connecting their places of business or residence. It is also prepared to manufacture all kinds of electrical apparatus.

Full particulars can be obtained at the Company's offices as above, or at St. John, N.B., Halifax, N.S., Winnipeg, Man., Victoria, B.C.

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Applicants must be between the ages of Twenty-two and Forty, active, able-bodied men of thoroughly sound constitution, and must produce certificates of exemplary character and sobriety.

They must understand the care and management of horses, and be able to ride well.

The minimum height is five feet eight inches, the minimum chest measurement 35 inches, and the maximum weight 175 pounds.

The term of engagement is five years.

The rates of pay are as follows :—

Staff-Sergeants............$1.00 to $1.50 per day.
Other Non-Com. Officers .. 85c. to 1.00 do

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1st year's service..	50c.	——	50c.	per day.
2nd do ..	50c.	5c.	55c.	do
3rd do ..	50c.	10c.	60c.	do
4th do ..	50c.	15c.	65c.	do
5th do ..	50c.	20c.	70c.	do

Extra pay is allowed to a limited number of Blacksmiths, carpenters and other artizans.

Members of the force are supplied with free rations, a free kit on joining, and periodical issues during the term of service.

Applicants may be engaged at the Immigration office, Winnipeg, Manitoba; or at the Headquarters of the Force, Regina N. W. T.

Money Orders.

Money Orders may be obtained at any Money Order Office in Canada, payable in the Dominion and Newfoundland; also in the United States, the United Kingdom, France, Germany, Austria, Hungary, Italy, Belgium, Switzerland, Portugal, Sweden, Norway, Denmark, the Netherlands, India, Japan, the Australian Colonies, and other Countries and British Colonies generally.

On Money Orders payable within Canada, the commission is as follows :

If not exceeding $4	2c.
Over $4, not exceeding $10	5c.
" 10, " " 20	10c.
" 20, " " 40	20c.
" 40, " " 60	30c.
" 60, " " 80	40c.
" 80, " " 100	50c.

On Money Orders payable abroad the commission is :

If not exceeding $10	10c.
Over $10 not exceeding $20	20c.
" 20 " " 30	30c.
" 30 " " 40	40c.
" 40 " " 50	50c.

For further information see Official Postal Guide.

Post Office Department, Ottawa.
1st November 1889.

FOR SALE.

The following first-class Phosphate lands in Templeton, P.Q :

West ½ of Lot	8, 10th	Con.,	100	acres.
South ½ "	16, 10th	"	100	"
"	11, 12th	"	215	"
"	12, 12th	"	190	"
South pt. "	13, 12th	"	50	"
North " "	21, 12th	"	147	"
"	11, 13th	"	161	"
"	12, 13th	"	132	"
"	17, 13th	"	47	"
			1142	acres.

These lands are held in absolute fee simple under Crown Patents. In addition to phosphate they contain many other minerals, among which may be mentioned ASBESTOS, MICA and BARYTES. As will be observed, most of the lots are in fairly close proximity, and they adjoin, or are actually traversed by a good county road, affording easy transit to the East Templeton Railway Station and Wharves on the Ottawa River. After personal examination Sir William Dawson, LL.D., F.R.S., F.G.S., the eminent Geologist, reported regarding this property: "In my opinion it has been very judiciously selected both with reference to probable yield of phosphate and facility of transport."

Application may be made to

Mr. L. Marcellais,
Perkins' P.O.,
East Templeton, P.Q.

Or to **Mr. L. T. Paterson,**
Box 2002, Montreal

TORONTO MINING

ASSOCIATION,

[LIMITED].

This Association is established to form a centre of information on all matters pertaining to Mining, and a suitable place where specimens may be received and examined.

It is intended to collect in the rooms of the Association specimens of all merchantable Canadian Minerals, with particulars as to place of deposit, and other information which may be useful both from a scientific and merchantable point of view. With this object the Association has decided to open rooms in Toronto within the next few weeks, where information can be sent and obtained, of Mining Properties for sale, and the undersigned has been appointed Managing Director.

The Stock Books of the Association are now open, and mining men and parties having mining properties to dispose of in all parts of the Province are invited to become members of the Association and to send information regarding their properties.

A person can become a member by subscribing for one share of $10 and by paying an annual membership fee of $4.

Further particulars can be obtained by applying to the undersigned,

A. S. THOMPSON,
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PROVINCE OF NEW BRUNSWICK.

Synopsis of "The General Mining Act, Chapter 16, 54th Victoria.

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GOLD AND SILVER.

Prospecting Licenses up to 100 areas, (each 150 feet by 250 feet), issued at 50 cts. an area up to 10 areas, and 25 cts. afterwards per area, good for one year. These Licenses can be renewed for second year, by payment of one half above amount.

Leases for 20 years to work and mine, on payment of $2 an area of 150 feet by 250 feet. Renewable annually at 50 cts. an area in advance.

Royalty on Gold and Silver, 2½ per cent.

MINES, OTHER THAN GOLD AND SILVER.

Licenses to Search, good for one year, $20 for 5 square miles. Lands applied for must not be more than 2½ miles long, and the tract so selected may be surveyed on the Surveyor General's order at expense of Licensee, if exact bounds cannot be established on maps in Crown Land Office. Renewals for second year may be made by consent of Surveyor General, on payment of $20.

Second Rights to Search can be given over same ground, subject to party holding first Rights, on payment of $20.

Leases.—On payment of $50 for one square mile, good for two years, and extended to three years by further payment of $25. The lands selected must be surveyed and returned to Crown Land Office. Leases are given for 20 years, and renewable to 80 years. The Surveyor General, if special circumstances warrant, may grant a Lease larger than one square mile, but not larger than two square miles.

ROYALTIES.

Coal, 10 cts. per ton of 2,240 lbs.
Copper, 4 cts. on every 1 per cent. in a ton of 2,352 lbs.
Lead, 2 cts. on every 1 per cent. in a ton of 2,240 lbs.
Iron, 5 cts. per ton of 2,240 lbs.
Tin and Precious Stones, 5 per cent. of value.

Applications can be fyled at the Crown Land Office each day from 9.30 a.m. to 4.30 p.m., except Saturday, when Office closes at 1 p.m.

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EXPRESS TRAINS leave Montreal and Halifax daily (Sunday excepted) and run through without change between these points in 30 hours.

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Passengers for Great Britain or the Continent by leaving Montreal on Friday morning will join Outward Mail Steamer at Halifax the same evening.

The attention of shippers is directed to the superior facilities offered by this route for the transport of flour and general merchandise intended for the Eastern Provinces and Newfoundland; also for shipments of grain and produce intended for the European market.

Tickets may be obtained and all information about the route, also Freight and Passenger rates, on application to

G. W. ROBINSON,
Eastern Freight and Passenger Agent,
136½ St. James Street, MONTREAL.

E. KING,
Ticket Agent,
27 Sparks Street, OTTAWA.

Railway Offices, Moncton, N.B., 14th November, 1889.

D. POTTINGER, Chief Superintendent.

MAP
—OF THE—
Phosphate Region
—OF—
OTTAWA COUNTY, QUEBEC.

PRICE, TWO DOLLARS.

On sale only at the Offices
OF THE
CANADIAN MINING REVIEW,
OTTAWA.

MINING REGULATIONS

TO GOVERN THE DISPOSAL OF DOMINION LANDS CONTAINING MINERALS, OTHER THAN COAL, 1890.

THESE REGULATIONS shall be applicable to all Dominion Lands containing gold, silver cinnabar, lead, tin, copper, petroleum, iron or other mineral deposits of economic value, with the exception of coal.

Any person may explore vacant Dominion Lands not appropriated or reserved by Government for other purposes, and may search therein either by surface or subterranean prospecting for mineral deposits, with a view to obtaining under the Regulations a mining location for the same but no mining location or mining claim shall be granted until the discovery of the vein, lode or deposit of mineral or metal within the limits of the location or claim.

QUARTZ MINING.

A location for mining, except for iron or petroleum, on veins, lodes or ledges of quartz or other rock in place, shall not exceed 1,500 ft. in length and 500 ft. in breadth. Its surface boundary shall be four straight lines, the opposite sides of which shall be parallel, except where prior locations would prevent, in which case it may be of such a shape as may be approved of by the Superintendent of Mining.

Any person having discovered a mineral deposit may obtain a mining location therefor, in the manner set forth in the Regulations which provides for the character of the survey and the marks necessary to designate the location on the ground.

When the location has been marked conformably to the requirements of the Regulations, the claimant shall within sixty days thereafter, file with the local agent in the Dominion Land Office for the district in which the location is situated, a declaration or oath setting forth the circumstances of his discovery, and describing, as nearly as may be, the locality and dimensions of the claim marked out by him as aforesaid; and shall, along with such declaration, pay to the said agent an entry fee of FIVE DOLLARS. The agent's receipt for such fee will be the the claimant's authority to enter into possession of the location applied for.

At any time before the expiration of FIVE years from the date of his obtaining the agent's receipt it shall be open to the claimant to purchase the location on filing with the local agent proof that he has expended not less than FIVE HUNDRED DOLLARS in actual mining operations on the same; but the claimant is required, before the expiration of each of the five years, to prove that he has performed not less than ONE HUNDRED DOLLARS' worth of labour during the year in the actual development of his claim, and at the same time obtain a renewal of his location receipt, for which he is required to pay a fee of FIVE DOLLARS.

The price to be paid for a mining location shall be at the rate of FIVE DOLLARS PER ACRE, cash, the sum of FIFTY DOLLARS extra for the survey of the same.

No more than one mining location shall be granted to any individual claimant upon the same lode or vein.

IRON AND PETROLEUM.

The Minister of the Interior may grant a location for the mining of iron or petroleum, not exceeding 160 acres in area which shall be bounded by north and south and east and west lines astronomically, and its breadth shall equal it in length. Provided that should any person making an application purporting to be for the purpose of mining iron or petroleum thus obtain, whether in good faith or fraudulently, possession of a valuable mineral deposit other than iron or petroleum, his right in such deposit shall be restricted to the area prescribed by the Regulations for other minerals, and the rest of the location shall revert to the Crown for such disposition as the Minister may direct.

The regulations also provide for the manner in which stone quarries may be acquired.

PLACER MINING.

The Regulations laid down in respect to quartz mining shall be applicable to placer mining as far as they relate to entries, entry fees, assignments, marking of localities, agents' receipts, and generally where they can be applied.

The nature and size of placer mining claims are provided for in the Regulations, including bar, dry, bench, creek or hill diggings, and the RIGHTS AND DUTIES OF MINERS are fully set forth.

The Regulations apply also to

BED-ROCK FLUMES, DRAINAGE OF MINES AND DITCHES.

The GENERAL PROVISIONS of the Regulations include the interpretation of expressions used therein; how disputes shall be heard and adjudicated upon; under what circumstances miners shall be entitled to absent themselves from their locations or diggings, etc., etc.

THE SCHEDULE OF MINING REGULATIONS

Contains the *forms* to be observed in the drawing up of all documents such as:— "Application and affidavit of discoverer of quartz mine." "Receipt for fee paid by applicant for mining location." "Receipt for fee on extension of time for purchase of a mining location." "Patent of a mining location." "Certificate of the assignment of a mining location." "Application for grant for placer mining and affidavit of applicant." "Grant for placer mining." "Certificate of the assignment of a placer mining claim." "Grant to a bed-rock flume company." "Grant for drainage." "Grant of right to divert water and construct ditches."

Since the publication, in 1884, of the Mining Regulations to govern the disposal of Dominion Mineral Lands the same have been carefully and thoroughly revised with a view to ensure ample protection to the public interests, and at the same time to encourage the prospector and miner in order that the mineral resources may be made valuable by development.

COPIES OF THE REGULATIONS MAY BE OBTAINED UPON APPLICATION TO THE DEPARTMENT OF THE INTERIOR.

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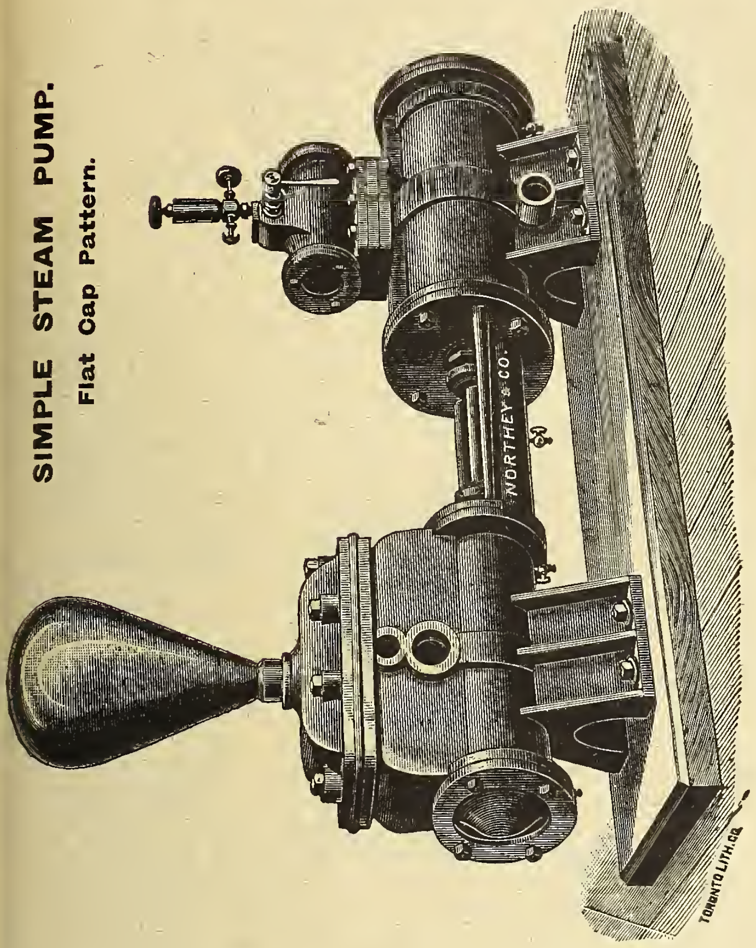
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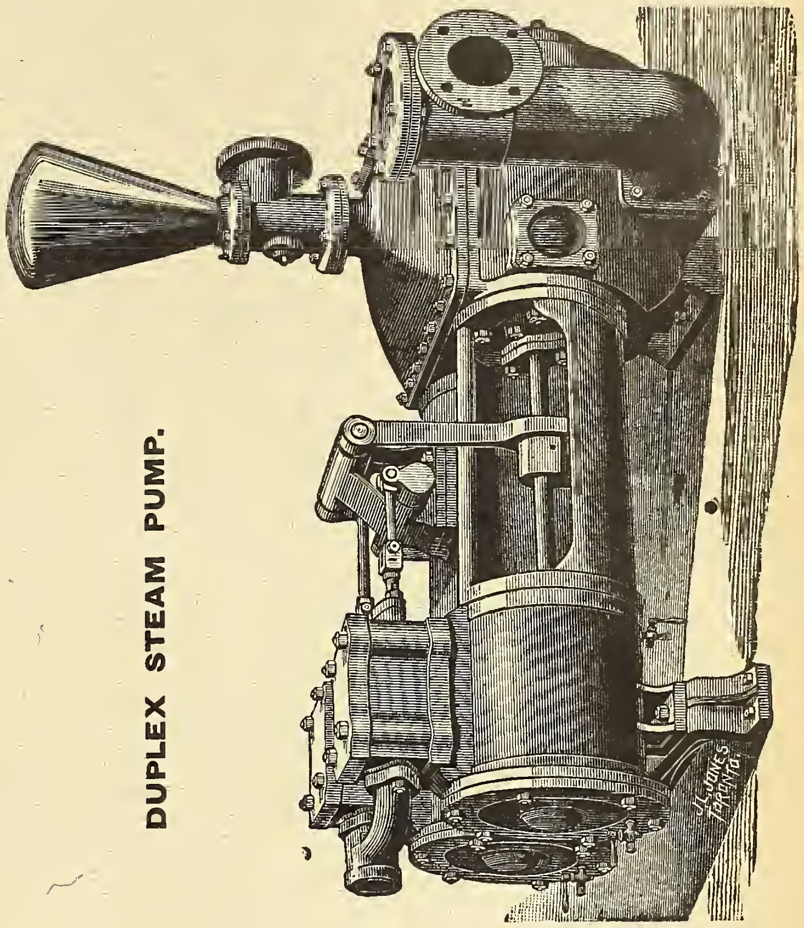

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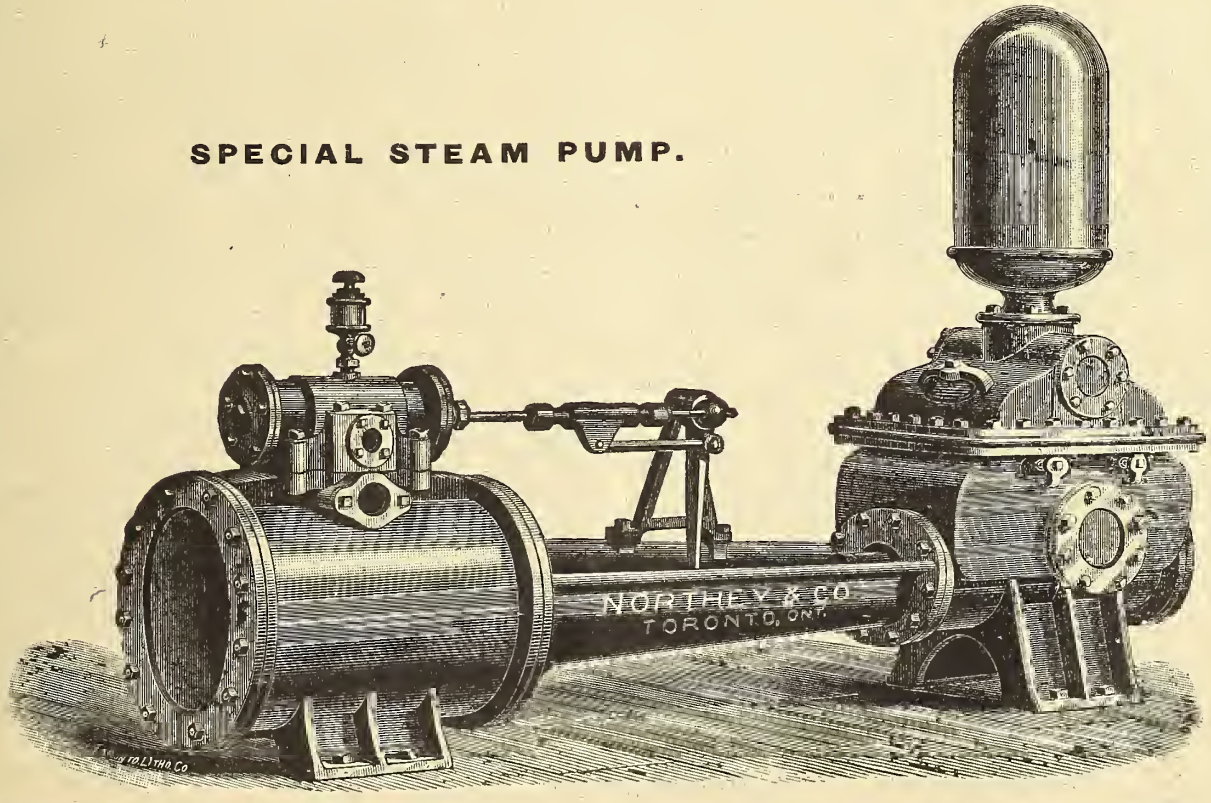
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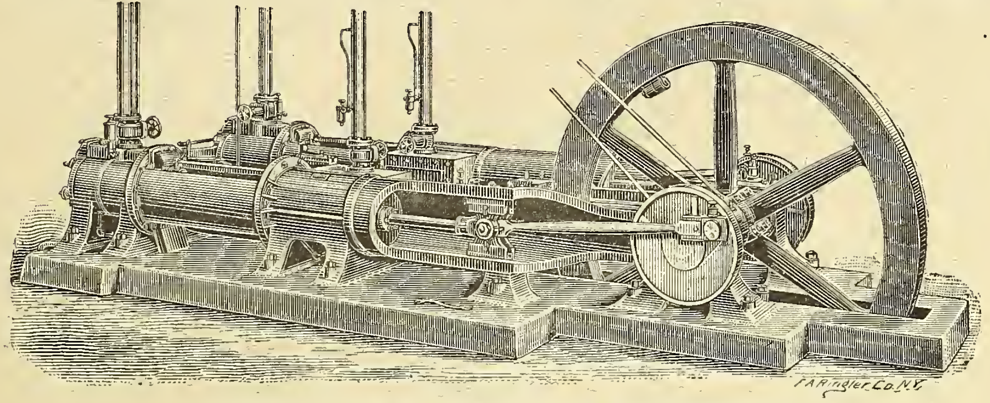
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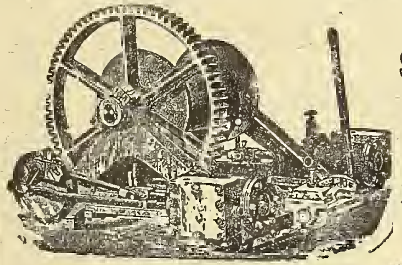

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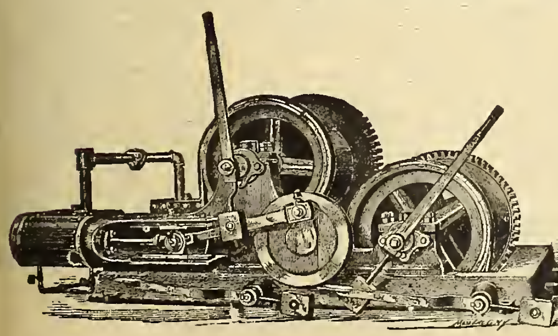

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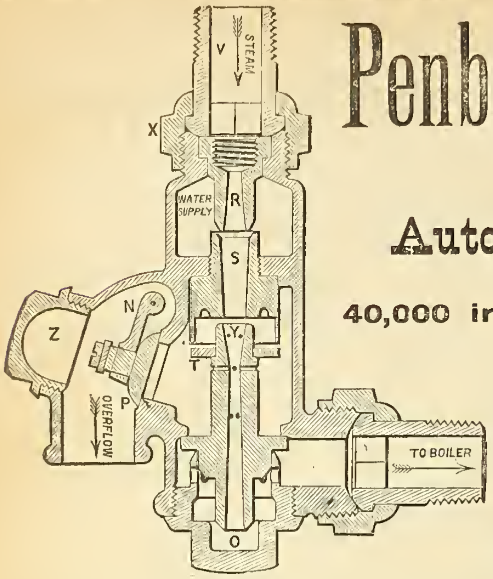

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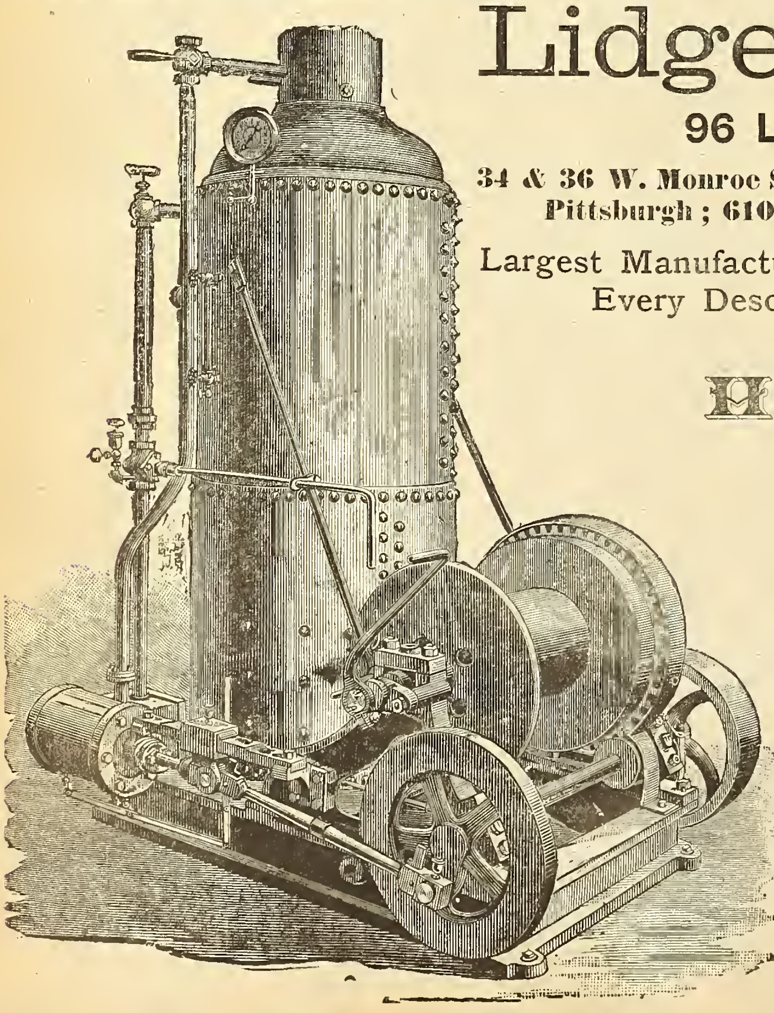

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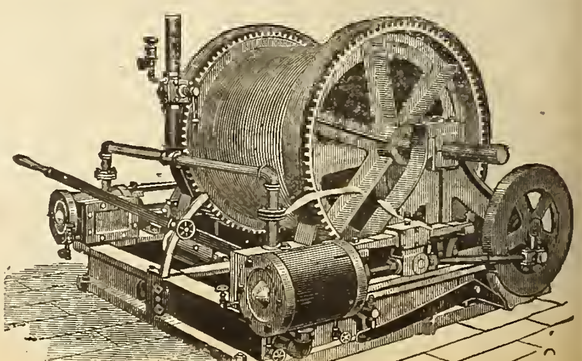

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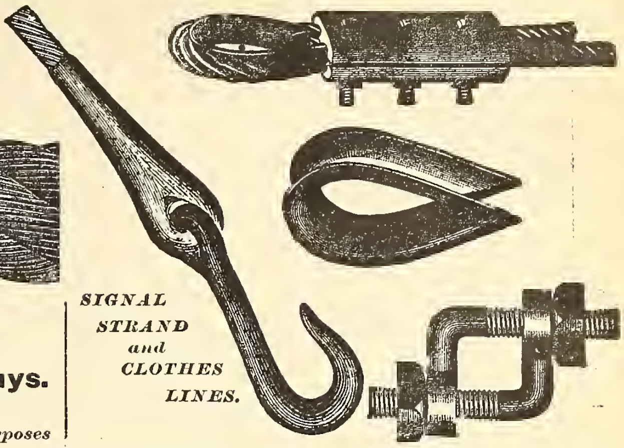

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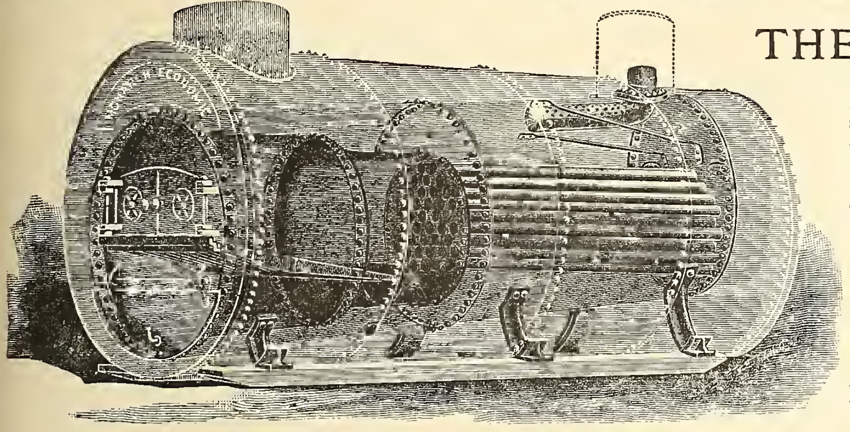

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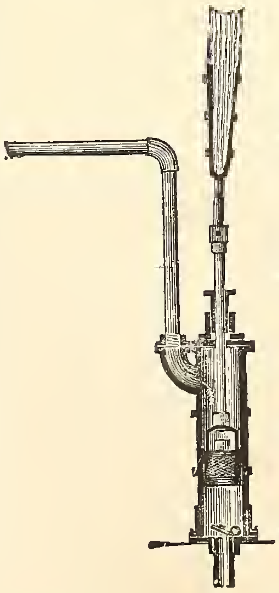

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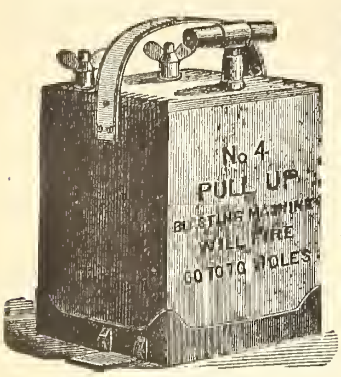

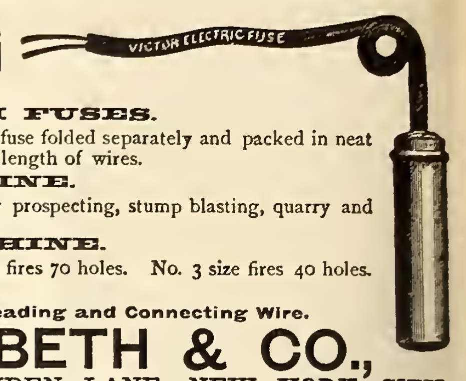

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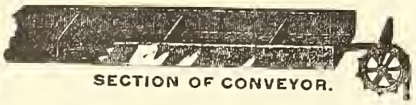

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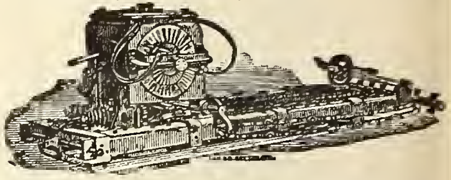

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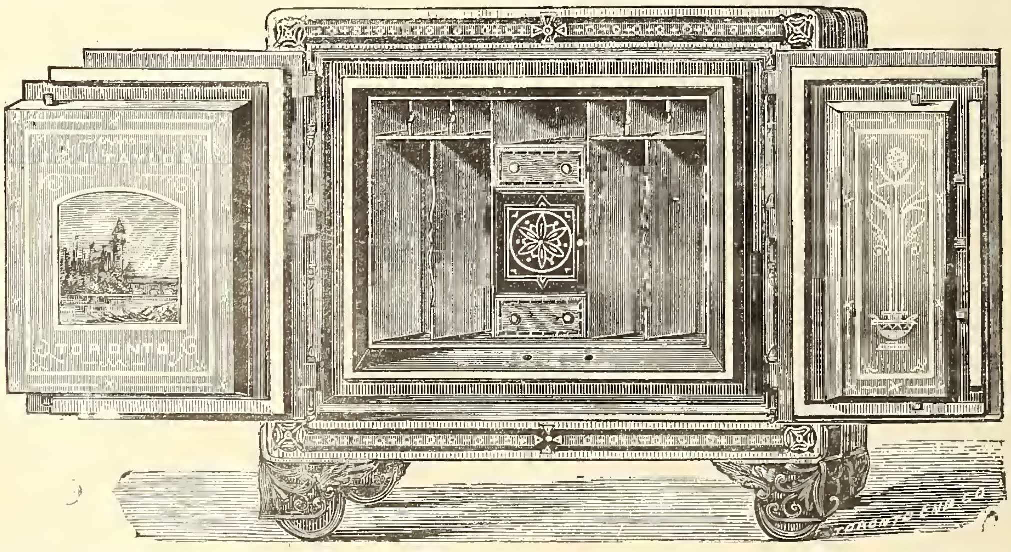

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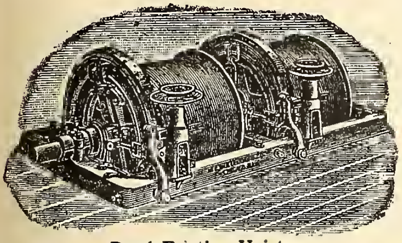

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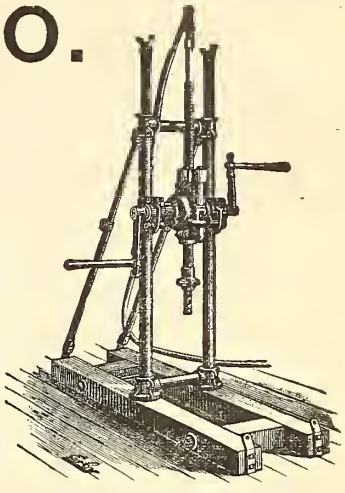

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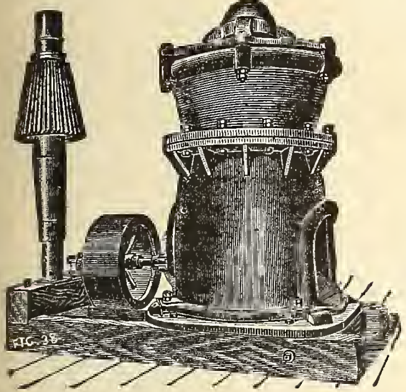

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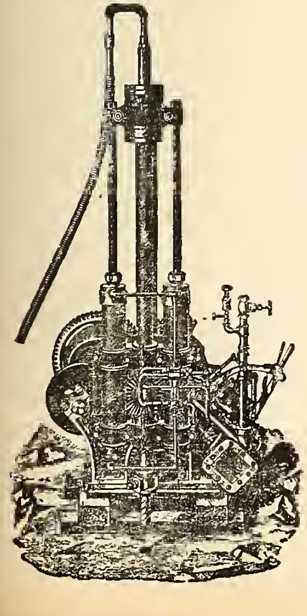

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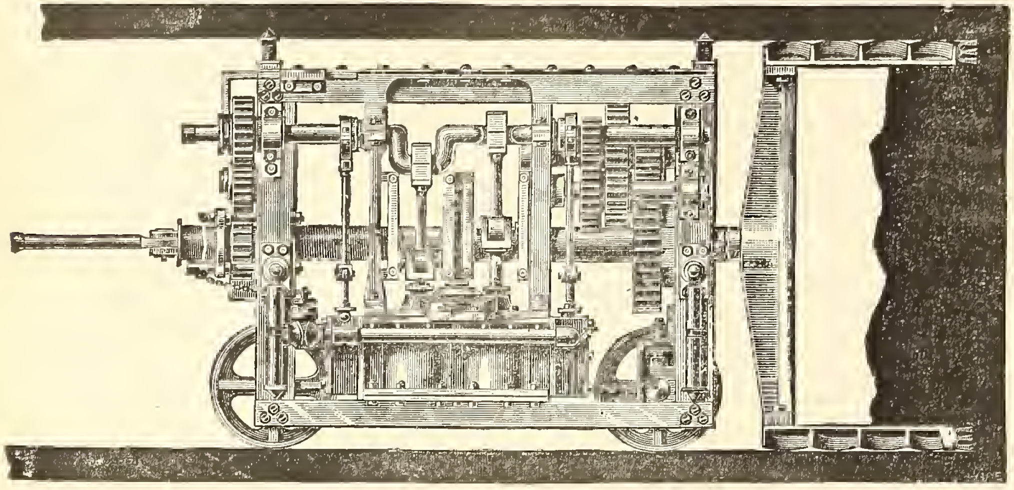

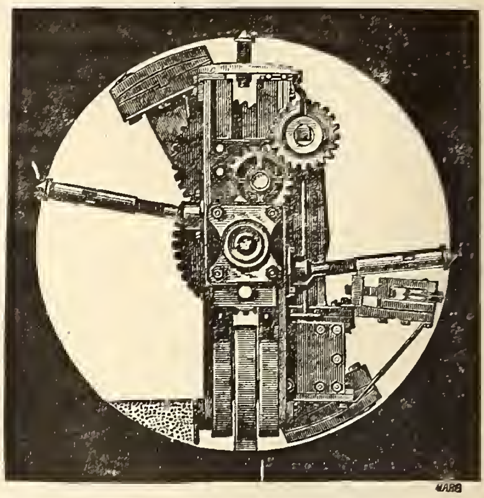

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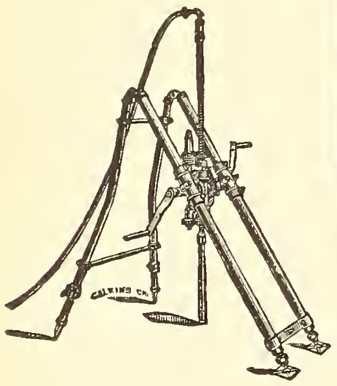

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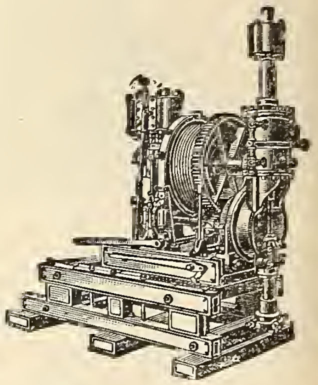

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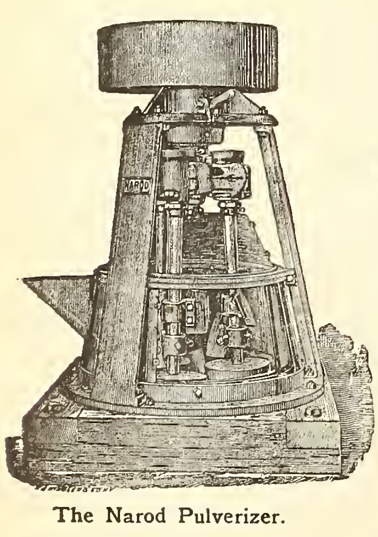

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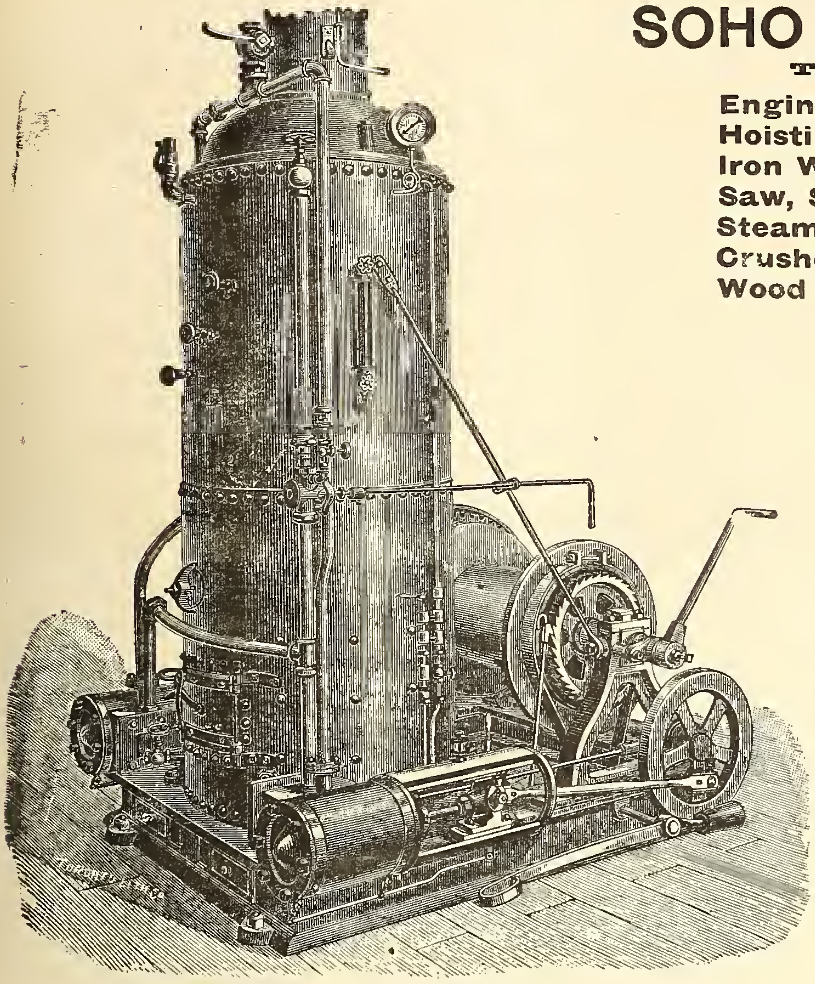

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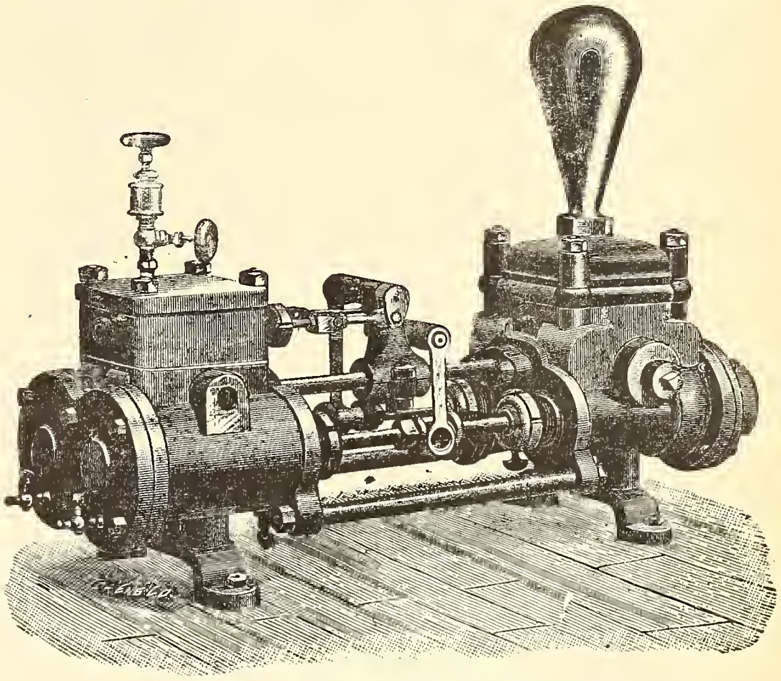

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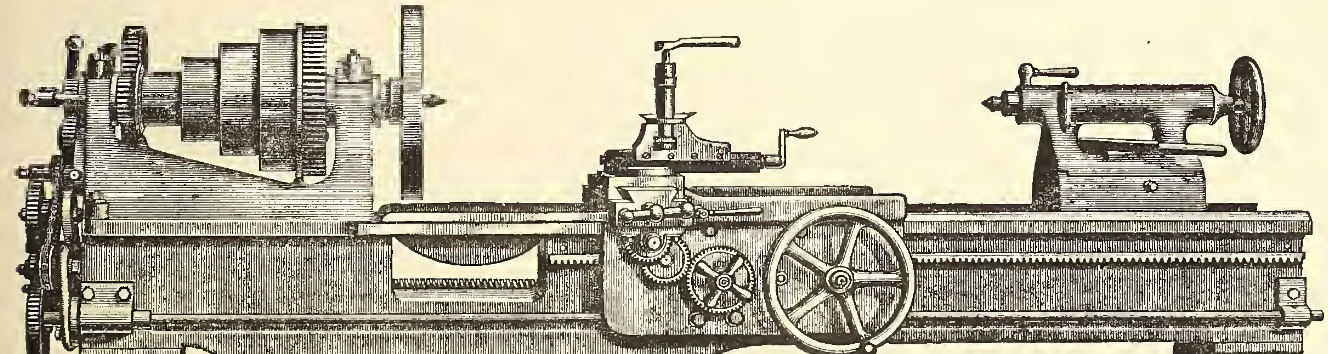

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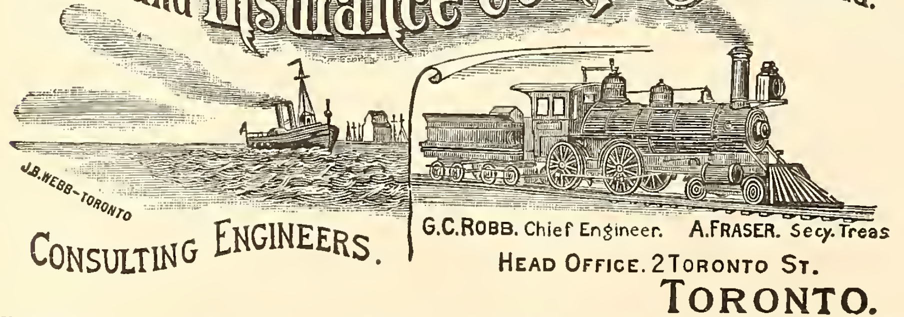

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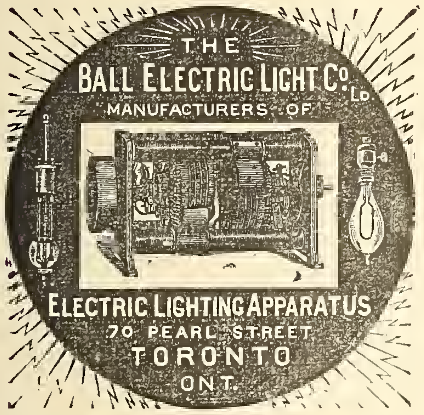

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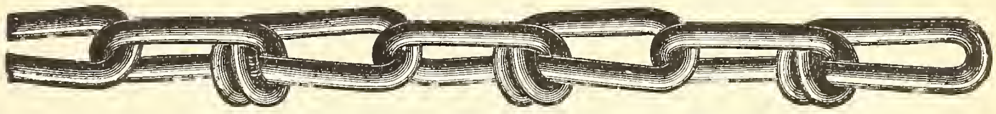

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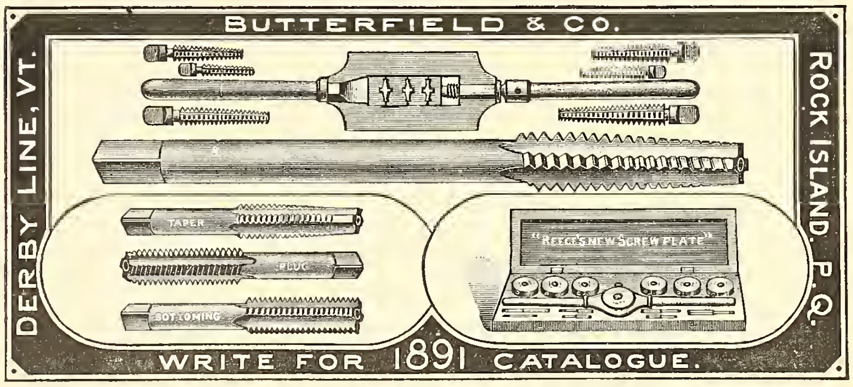

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Applications for Licenses or Leases are receivable at the office of the Commissioner of public Works and Mines each week day from 10 a.m. to 4 p.m., except Saturday, when the hours are from 10 to 1. Licenses are issued in the order of application according to priority. If a person discovers Gold in any part of the Province, he may stake out the boundaries of the areas he desires to obtain, and this gives him one week and twenty-four hours for every 15 miles from Halifax in which to make application at the Department for his ground.

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Licenses to search for eighteen months are issued, at a cost of thirty dollars, for minerals other than Gold and Silver, out of which one square mile can be selected for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

All rentals are refunded if afterwards the areas are worked and pay royalties. All titles, transfers, etc., of minerals are registered by the Mines Department free of charge, and provision is made for lessees and licensees whereby they can acquire promptly either by arrangement with the owner or by arbitration all land required for their mining works.

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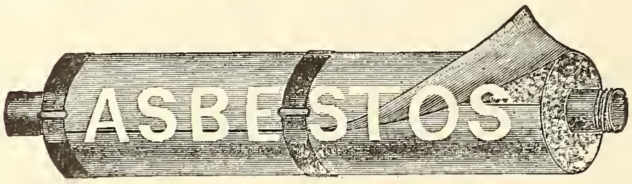

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1. In Algoma, Thunder Bay, Rainy River and that part of Nipissing north of Lake Nipissing and the French and Mattawa Rivers, the price per acre of mining lands sold after the 4th day of May, 1891, is $4.50 in a surveyed township, and $4 in an unsurveyed territory, if within 12 miles of a railway, and if beyond that limit $3.50 in surveyed and $3 in unsurveyed territory. Elsewhere the price is $3 in a surveyed township any part of which lies within 12 miles of a railway, and $2 if at a greater distance.

2. Instead of by grant in fee simple, mining land may be obtained under a ten years' lease at a per acre rental, unless otherwise fixed by regulation, of $1 for the first year and 25 cents yearly thereafter if north of Lake Nipissing and the French and Mattawa Rivers, or of 60 cents for the first year and 15 cents yearly thereafter, if situated elsewhere, with right of renewal at the expiration for an additional ten years at the same rentals, and with a right of renewal thereafter every twenty years, subject to payment of the yearly rent charge in advance and to such conditions as may be provided by regulation. But the lessee may at any time purchase the land so held, in which case the first year's rent shall be treated as part of the purchase money.

3. The owner or lessee of mining land sold or leased by the Crown after the 4th day of May, 1891, is required during the first seven years to expend in actual mining operations $4 per acre if the location exceeds 160 acres, and $5 per acre if it is 160 acres or less.

4. After the 4th day of May, 1891, all ores or minerals of silver, nickel, or nickel and copper, taken from lands sold or leased by the Crown, are subject to a royalty of 3 per cent., and all other ores or minerals to such royalties as shall from time to time be fixed by Order-in-Council, not exceeding in the case of iron 2 per cent., and as to any other ores or minerals not exceeding 3 per cent.; and such royalties shall be calculated upon the value of the ores at the pit's mouth. But royalties shall not be imposed or collected upon any ores until after seven years from date of the patent or lease, except as to mines known to be rich in nickel, and as to these not until after four years.

5. Hereafter in all lands sold under the Public Lands Act, or for agricultural purposes, all minerals and mining rights are reserved to the Crown, unless otherwise provided in the patent or grant.

6. In the case of mining lands for which bona fide application was made in writing to the Department prior to the 24th April, 1891, grants may be made where the application is received within three months from the 4th day of May, 1891, and otherwise at the price and upon the conditions heretofore applicable in accordance with the terms of section 1, sub-section 5, of the Act of 1891.

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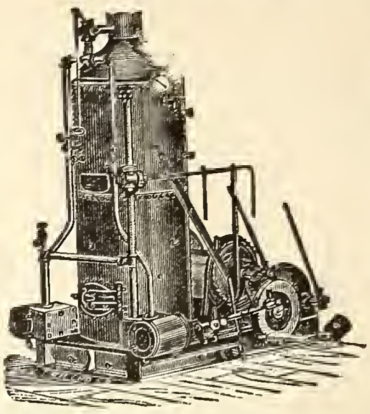

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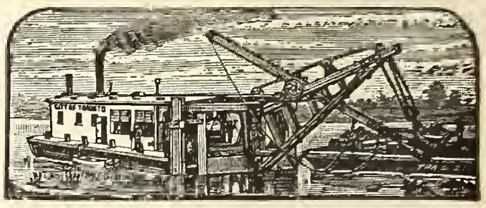

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Vol. X. SEPTEMBER, 1891. No. 9.

Outlets for Nova Scotia Coal.

The great drawback to coal mining in Nova Scotia has been the loss of time caused by the closing of navigation in winter. When it is remembered that the costs of pumping, ventilation, etc., remain proportionally nearly the same whether a coal mine is working or standing idle, it will be seen that the matter is of almost more than private interest. In addition, at this season the workmen become scattered, and many leave for other localities where they expect steadier work, or seek occupations promising more continuous employment.

In the County of Cumberland the large and continuous demand for coal by the Intercolonial, Grand Trunk and Canadian Pacific Roads has hitherto allowed of steady winter work. But as the collieries at present working practically meet this demand, the market is not assured enough to encourage the opening of more mines. Pictou County for many years practically ceased exporting coal in winter, and even now the winter land and railway sales serve but partially to keep the collieries running.

In Cape Breton County, however, is found the worst state of affairs. Here the heavy rates of insurance deter the shipments up the Gulf of St. Lawrence when the month of October is reached, although, as a matter of fact, the Gulf of St. Lawrence is safer for steamship traffic in October and part of November than in the summer months, as the autumn gales are less to be dreaded than the fog, and shipments are not under way again till the following April. During the winter months there is practically no local sale of coal, as wood is everywhere abundant and the Island railway calls for only a few thousand tons.

An attempt is being made to partially neutralize this inactivity during the winter, by cutting and banking coal during the two months preceding the opening of navigation, and the colliery generally has from 5,000 to 20,000 tons of coal ready. This coal, however, makes slack when exposed, and it is frequently found necessary to ship it in small quantities with the freshly mined coal to prevent complaints from customers. Moreover, as the able-bodied labor of the Island finds its annual farming, fishing and other work confined to the same limited period, it is often difficult for the collieries to secure men for the prompt removal of these coal banks. Under these difficulties it is only by the exercise of great economy and care, and the unrivalled advantages offered by the Cape Breton district for cheap and regular coal mining, that the operators are able to conduct their business so as to secure a reasonable profit.

Enthusiastic supporters of the railway recently built by the Dominion Government from the Strait of Canso to the centre of the Sydney coal field, promised that its construction secured for Cape Breton coal a continuous winter outlet to the markets of Quebec and Montreal. But a railway carriage of 200 miles, in addition to a transfer at the Strait of Canso, would only bring the coal abreast of the Pictou collieries, and 100 miles short of the Cumberland coal field.

It is possible that almost continuous winter shipments could be made from Sea Coal Bay, at the entrance of the Strait of Canso, but this would mean a railway carriage of about 100 miles, or about one dollar a ton in addition to the water freights. As the only markets available at this season would have to be sought in the United States, it is not to be expected that the prospects of securing a market, with the freights increased by a land carriage, would be materially improved over the present state of affairs. A partially successful attempt was made some years ago to demonstrate the adaptability of Louisburg as an all-winter port. It is generally believed that fairly continuous shipments could be sent by this port in winter, and it is understood that the Dominion Government will continue their railway to this harbor, by a line affording facilities to the principal mines. However, it is difficult to see how, in the face of the present tariff and the limited demand for Provincial coal in the United States, that any large shipments can be made from this point. It may be remarked that, if this harbor can be utilised for winter shipments, many of the local coast ports could be supplied in winter, giving the mines greater facilities for the Gulf shipments during the summer season.

The question of utilizing Louisburg so as to provide for an export trade to the United States capable of keeping the mines fairly employed during the winter, turns principally upon the cost of production. The means to this end may be sought for in the employment of mechanical coal cutters, the acceptance of lower prices by both operators and workmen, and the cheapening of transport. The latter involves the acquisition by the companies or by a corporation interested in the mines, of suitable coal-carrying steamers, or possibly of a line of barges for towing to New England ports.

A successful attempt is now being made on a small scale of towing coal from Sydney to Halifax, and the extension of the service to more distant points is only a question of increased power. The Pictou district, if desirous of securing a winter outlet by sea, can turn only to Halifax, which involves a railway carriage equal in length to that already referred to, from Sydney to the mouth of the Strait of Canso, but with the advantage of a shipment assured of no interruption from ice. The port of Parrsboro' offers excellent facilities for winter shipments, as it is readily accessible, and tugs of moderate power could take large tows. In fact from this point it would seem that even with the opposing duty levied in the United States, a fair attempt could be made now to introduce Cumberland coal in that market.

In addition to these possible outlets for coal, much more might be tried by the coal companies to increase the local consumption of coal. Inducements of cheap fuel might induce manufactures to locate near the mines. By this means much slack coal now wasted could be utilised. Collieries having abundance of land could advantageously add the offer of free sites. Arrangements could be made for the manufacture of coke for use in baseburner stoves, for the replacement of hard coal by slack and nut coal in hot water heaters, etc.

EN PASSANT.

We have to acknowledge the receipt from the Arkansas Geological Survey of a very valuable Report on Manganese, compiled by Dr. R. A. F. Penrose, who, it will be remembered, was some years ago connected with one of our phosphate mines in Ontario, and who is now Assistant State Geologist. He has given extraordinary pains to the work, having personally visited every mine in Arkansas, and embodied a description of each in the report. Besides describing the occurrence of ores in Arkansas, the subject of manganese has been taken up as a whole, which led to an investigation of the different kinds of ore and the uses to which they are put. It became necessary, then, to know to what extent the other mines in the country could meet the demand for manganese, entailing a visit to each. But as the funds appropriated were not available for work outside the State, Dr. Penrose himself met these expenses out of his own private funds, and in addition to the field work on manganese in his own state, visited and examined every known manganese region in North America, from Nova Scotia and New Brunswick, and from the Atlantic to the Pacific. The conclusions given in the Report are therefore based upon direct personal observations and are thoroughly trustworthy. The volume has been prepared upon the general plan of discussing: 1—The uses of manganese, together with the history and statistics of the manganese industry; 2—The ores of manganese; 3—The nature of the manganese deposits. The comprehensive nature of the work will thus be seen, and it may be said that the author has in every respect worthily carried out his aims.

The German exploring expedition to Spitzbergen appears to have made a rather noteworthy discovery of coal in that region of "thick ribbed ice." So far as the competition from this coal field at the North Pole is concerned our miners may keep their minds at ease. Not even the promise of an eight-hours day or the hope of a ten per cent. dividend would get that seam opened.

William Crookes, Esq., F.R.S., has joined the board of the General Phosphate Corporation (Limited).

The United Asbestos Co. has for the seventh time secured the contract for the supply of all kinds of asbestos manufactures required for Her Majesty's Navy during the ensuing year.

In a paper read before the recent meeting of the British Association, some figures were given as to the progress of thrift among miners in recent years. This year the miners' societies have 268,971 members, a revenue of £242,658, and £367,293 accumulated funds; while 2,395 widows and 3,842 children are in receipt of allowances. In the course of the year 1890 39,411 cases of disablement were dealt with.

The disastrous effects of strikes to the working-men have been forcibly shown by Mr. E. Trow, one of the labor representatives on the Royal Commission on Labor in England. Not only is the ratio of success to failure very slight, but the loss in wages very heavy; and still more, the loss of the market is often entailed by a stoppage of work, which means that employment cannot be regained. There is a very pointed moral in this, which the working-men, in spite of sad experience, seem slow to discover.

Attention to the utility of our low grade micas for electrical purposes continues to increase and there is a strong demand for quantities of this hitherto unmarketable product. Prices are reported on the rise, but we have heard of sales on the following basis: Size measuring 1½ x 2½, $25 per ton; 1½ x 5½, $100 to $150 per ton; 4 x 6, $200 to $250 per ton; 4 x 8, $300 per ton.

High freights, a depressed market, and the imposition of an iniquitous tax by an ignorant and unscrupulous government, has strangled, for the time, the production of phosphate, once one of the most promising of our industries. The following mines have closed down: North Star, Foxton, Central Lake, McLaurin, Ross Mountain, Canadian Phosphate Co. and Boyd-Smith, while at the Emerald, Anglo-Continental, and other works, a very considerable reduction is noticeable, *and the end is not yet.*

English investors, we understand, are not disposed to take hold of Canadian securities at present, on account of the various scandals that have been given perhaps more prominence than their importance deserves. And yet we find these same sapient capitalists sinking their money in a concern such as the Egyptian Minerals Corporation, a company designed to acquire and develop the minerals supposed to exist in the land of the Pharaohs, but which has come to a disastrous, but not unexpected end. If the caution, not to say suspicion, with which Canadian investments are eyed, were transferred to other quarters, and in their place more confidence was displayed, our friends on the other side of the herring pond would find themselves more in pocket.

Commenting upon the present depressed state of the phosphate market in Europe, one of our correspondents writes: "It becomes daily more difficult to sell high grade phosphate, and recently 75% to 80% has been offered at 11d. Canadian 80% is to-day not worth more than 1s. per unit, and even at such price would find no eager buyers. Contrast this price with the 1s. 4d. and 1s. 4½d per unit of eighteen months ago, and the prospects then ruling of still higher values."

In connection with the projected underground rapid transit system for New York, an electrician has published an undertaking to produce, within a given time, an electric motor capable of drawing a train of six loaded carriages at the rate of 40 miles an hour, or forfeit $50,000. The specific object of the proposed system is not so much to convey passengers underground as to convey them quickly—that is to say, at 40 miles an hour. If Mr. Sprague, the electrician referred to, can accomplish what he has undertaken, the rapid transit system will be commenced forthwith. We do not want any such speed for underground mining work, but any improvement in electric motors must bring some benefit in their application to industrial purposes.

The following statistics of the exports of Florida phosphates for the first six months of the year are interesting:—

January 1st to June 15th, 1891.

	TONS.	
Shipped from Peace River to Europe.......	10,220	55/60
" " " U. S. ports...	6,525	
Railed " " inland points..	5,000	
Peace River total..........	21,745	
Shipped from Fernandina to European ports.	16,373	75/85
" Tampa.....................	7,475	
" Brunswick.................	780	
" Jacksonville.	660	
Railed to inland points, estimated..........	3,000	
Total....................	50,033	

In the ship building of the last decade there has been no more remarkable development than the construction of enormous iron and steel sailers. The other day the "Drumrock," a vessel constructed to carry about 4,800 tons, was launched at Leith, in Scotland, and it is announced that another firm of Scotch ship-builders, Messrs. Russell & Co., of Greenock, have contracted to build a steel sailing ship of still greater capacity, which will be the largest steel sailing ship afloat. In long voyages such as the nitrate trade with Chili, the wool trade of Australia, the Calcutta jute trade and the Java sugar trade, no species of shipping pays so well as these vast sailers, which cost little more than $50 a ton to begin with, and repay their owners within ten years. The Province of Nova Scotia, with its immense deposits of iron, coal and limestone, offers peculiarly favorable conditions for the construction of these vessels, and, to quote from a former article, "why should the Gulf coal-carrying trade not be in the hands of those who are also shareholders in the Nova Scotia coal mines, and why could not the provincial ship husband tend with equal success the freights of this class of vessel, suceeding by the inexorable laws of progress to the sailing vessel of his youth."

In another part of this issue will be found a very valuable paper on "The Early History and Progress of Coal Mining in Nova Scotia" by Mr. John Rutherford, M.E., the first Government Inspector of Mines for Nova Scotia, and who, by virtue of his long and intimate connection with the trade, is acknowledged to be the best authority on the subject. The figures and comparisons are especially interesting; and the promise of the title has been literally fulfilled, the coal industry being traced from its crude beginnings to its present position with as full data as can be given.

Mr. Samuel D. Mills, a gentleman well known to many of our readers in the Province of Ontario, and recently Superintendent of the Martel Furnace Co., at St. Ignace, Mich., has been appointed General Superintendent of the New Birmingham Iron and Improvement Co., of New Birmingham, Tex., and in a letter under date of 29th ult. he says: "We are working on an ore resembling somewhat the bog-ore of Lower Canada, but here it is found only on the tops of the hills, covered by from one to nine or ten feet of alluvial deposit of varying nature—sometimes sand, sometimes clay. The ore forms a solid layer or blanket deposit 1½ ft. to 4 ft. in thickness, and carries 44½ to 52% metallic iron. It is mined, or rather rooted out, so to speak, and delivered at the furnace at an average cost of 70 cents per ton, the process of mining consisting of removing the surface dirt by means of ploughs and scrapers, and then prying out and breaking up the ore with levers, bars, sledge hammers and gads. This ore makes a very strong iron, well adapted for car wheels, as well as for general foundry work. We have a 50-ton furnace here, built from the designs of Mr. John Birkinbine, of Philadelphia, and the whole plant is, of course, of the most modern type. There is also in process of construction, by a separate company, a pipe plant which will have a capacity of about 30 tons of cast-iron pipe per day. We hope soon to have a machine shop, and the prospects are that a large rolling mill will follow before long."

The annual report of the Secretary for Mines, Victoria, states that during the past thirty years the whole of Victoria has been more or less searched for auriferous alluvium. Such deposits wherever occurring in considerable amount and at a moderate depth have been very generally searched out and worked. Each year during the continuance of the prospecting grant similar prospecting has been carried on, and the conclusion is come to that in more or less inaccessible localities, or at considerable depths below the surface, the harvest of alluvial gold has been gathered in. Yet the conclusion that the alluvial gold mines of Victoria are being altogether exhausted must not be taken in too sweeping a sense, for there are still very large tracts of virgin country, wherein there is every probability that extensive deep leads will be found containing rich deposits of gold. Such deep leads are, for instance, to be found covered with sheets of basalt along the course of the great auriferous belt extending from Ballarat northwards, in which some of the richest gold fields have been situated. It is to the diamond drill, working in sites selected by trained geologists, that we must look for information as to where these old leads are to be found, and it is for capital to follow and develop them. As regards quartz mining the report states that although the expenses inseparable from the working of quartz lodes are as great or possibly in some cases greater than those necessary for alluvial mining, yet owing to the continuous improvements being made in milling machinery and other appliances, the greater percentage of gold saved has so far prevented the annual decrease being very pronounced. Nevertheless it must now, it is stated, be fully recognised that as a natural consequence the aggregate quantity of gold obtained from the mines of the colony will be less each succeeding year, but the decrease may be minimised by the success.

The evidence brought forward in an English court recently, implies an extraordinary lack of honesty in the rules of conduct of the London Stock Exchange. The action in question was brought by Messrs. Raffer & Sons, foreign brokers, against the well-known firm of Sebag, Montefiore & Co., to recover £698, the value of a Spanish Exterior Debt bond, sold to them as valid, but the payment of which had been stopped some years ago by a decree of the Spanish courts. The chairman of the Stock Exchange Committee, who was called as a witness, deposed that it was according to their rules for the vendor of a stopped bond knowing it to be such, to sell it to a purchaser who did not know. That such a state of affairs should obtain in such an institution is indeed surprising, and it behooves Canadians who have any dealings with the London Board to be careful that they are not duped in some way permitted by the very lax regulations of the brokers.

Heroes there are in every walk of life, but among one class of men, miners, hundreds of daring acts are done of which the outer world knows nothing. Occasionally some more than usually courageous deed does find its way to the surface, and of such a nature was that performed the other day by a miner named Joseph Walker, at the Postlethwaite Iron Ore Mines at Frizington, in the north of England. He was engaged with his son and two other men in removing some props from the roof in order to put in others, when the timber gave way and a large quantity of metal and other stuff fell down upon his son and the two other men. Making a detour, Walker got to the other side of the fall and found that his son had been killed outright and that his companions were fast in the *debris*. As his own lad was past help the courageous fellow at once commenced the work of rescuing others. The other men in adjoining workings refused to assist, as they feared a further fall, and for an hour, with his dead son lying near, and with pieces of metal repeatedly falling about and upon him, he continued his task, so great being his danger that even one of the imprisoned men begged him to desist, as he could not liberate them, and would probably lose his own life. But the gallant fellow was not to be deterred from doing his best, and he ultimately, single-handed, rescued both men At the inquest subsequently held, the coroner said he could not express his admiration for the gallant conduct of Walker. Under the circumstances most men would have been upset by the death of a son, and left the rescue to others. But he did what others dared not. A greater piece of heroism has seldom been shown.

The question, Does mining pay? has been often asked and it is too often the custom to reply with a decided negative. Statistics, however, which are the only sure method of arriving at exact results, make a very different answer, and show conclusively that mining, conducted on practical and economic principles, not only pays, but gives returns in the aggregate such as no other class of securities can present. An interesting table is given in the volume on "Mines and Mining" recently issued by the United States Census Bureau, in which we find the following: Product of the mines for the year ending June, 1890, $556,988,450; number of industrial mining establishments, 30,000; number of persons employed, 512,114; annual wages in mining, $212,409,809; capital engaged in mining, $1,173,000,000; product in sight on capital invested, 50 per cent. But if we take authentic reports from some of the best known mines, we shall discover still more remarkable profits:—

Name of Mine.	Capital.	Quarterly Dividends.	Total Dividends Paid.
Ontario	$15,000,000	$225,000	$11,975,000
Granite Mountain	10,000,000	600,000	11,000,000
Yankee Girl.....	1,300,000	150,000	2,000,000
New Guston.....	550,000	110,000	832,500

Mining has been given a bad name in many quarters on account of the unblushing frauds so often perpetrated upon the investing public by bogus companies, but if investors would only exercise a little more judgment and not be so readily taken in by specious promises, these would decrease in proportion as they become no longer profitable.

Some of the great gold quartz veins of Australia are considered by very high authorities, says Dr. Willis E. Everette, in the *Australian Mining Standard*, to have been formed from a deposition of quartz and silica, by condensation from an aqueous solution of an alkaline silicate of gold. The microscopic researches of both Sorby and Howitt, have shown that in the minute cavities of vein silica or in crystals of quartz, an aqueous fluid has been found which, upon analysis, has been shown to consist of water, holding sulphates and chlorides of potash, soda and lime in solution, all of which substances are earth alkalies. Also in this fluid found in the minute cavities of vein quartz, even free sulphuric and chlorhydric acids have been found, thus giving rise to the former possible combination of an aqueous solution of an alkaline silicate of gold, with aqueous solutions of the hyposulphites and chlorides of gold, the free acids being formed as soon as the conversion of the gold in the metallic state took place. Following up this line of reasoning every peculiarity of the genesis and structure of an auriferous or gold-bearing quartz vein can be explained by presuming that the depositions of the quartz came from water which held alkaline silicates, salts and acids in solution, and precipitated them upon condensation of this aqueous solution, which was then followed by crystallisation of the silica into quartz and the silicated gold into metallic gold. The associated minerals found in the veins of quartz with gold may also have been derived from the same sources.

A French mining engineer, says *Iron*, has devised a new system for reducing to a minimum the disastrous results of an explosion from firedamp. He proposes to divide a mine into four parts, and to sink in each quarter two shafts, starting from the surface and terminating in the workings, one shaft to be arranged at the side of the intake of fresh air, and the other at the place of the return of the air. These shafts, not exceeding 40 inches in diameter, are to serve for the entrance and exit of the air, and are to communicate through the galleries, which constitute distinct blocks. Water and air-tight doors, protected from fire by sheet metal, are to isolate each quarter, the aeration of which would be effected by the shafts. According to the inventor, if a firedamp explosion occurs, it would be restricted to the quarter in which it originated, and by the arrangement of the doors, etc., the force of the explosion would be confined to that part of the mine and shafts, which would offer an immediate outlet for the gases. The other portions of the mine would, it is maintained, be unaffected, and the accident would be restricted to a small number of workers, and to a limited portion of the workings.

Those of our readers who are concerned in the outcome of Mr. Mercier's mining legislation, will be interested to know that representatives of the General Mining Association have had a personal interview with the Premier with the object of securing a test case as to the validity of the Act. It is understood that the Quebec Government will agree to this.

Mr. Henry Hall, one of Her Majesty's inspectors of mines, in a recent paper before the Manchester Geological Society, contributes some interesting statistics with reference to falls of soft and hard coal. He finds that in North-east Lancashire and Ireland, during the last seventeen years, there have been 567 persons killed; in West Lancashire and North Wales, 373; in Durham, 740; in Northumberland, 525, and in the United Kingdom, as a whole, 7,790 persons, or 45 per cent. of the total deaths about mines. Mr. Hall comments strongly on the weakness of the system of the men doing the timbering. "It simply comes to this," he says, "that the officials go into the working places and see the men at work. Instead of taking an interest in seeing how the place is timbered, they simply say to the man, 'you must take care of yourself,' and nothing more passes between them. The man has ever to depend on his own skill, and I think naturally, if men are selected to do certain work and are kept at it, they get more skilled at it. Besides, when men are employed solely at timbering there is no monetary consideration with them. They work by the day, and may spend as much time over their work as they like. When the collier, on the other hand, does his own timbering, it is against his interest to spend time upon it. Every minute he gives to it means so much money out of his pocket. The two systems will not bear comparison."

Australia has the leading mine of the world. This is clearly shown by the reports presented at the twelfth half-yearly general meeting of the Broken Hill Proprietary Company held at Melbourne in July last. The chairman stated that one-eighth of the lode in their claim down to the 300 foot level had been extracted, producing 787 tons of silver and 108,000 tons of lead. There is, he added, seven times as much ore remaining as has already been treated, making an allowance for full one-third of the bulk being waste and useless material. Some idea of the immense extent of this company's operations may be gathered from the fact that directly and indirectly the mines give employment to at least 5,000 men; the company's freightage requirements keep actively employed tonnage equal to 22 steamers of 3,000 tons capacity each, while the dividends paid are equal to 50 per cent. or half of those paid by the 20 banks of issue in Australasia. The dividends paid annually have amounted to £1,250,000.

Having regard to the superior excellence of nickel-steel armour plates, which has recently been demonstrated, it may not be amiss to quote the remarks of a recognised French authority, M. Mercadier, bearing on the elastic properties possessed by nickel-steel. This gentleman, who has spent many years in investigating the subject, is of the opinion that steel alloyed with nickel is destined to play a still greater role in the metallurgical world. By means of the acoustic method which he has invented, M. Mercadier finds that steel containing nickel in the proportion of 25 to 100 is perfectly homogeneous and almost completely isotropic. The incorporation of the nickel with the steel in sufficient quantity, he adds, while increasing the homogenity of the material, imparts to it an isotropy similar to that of the belles glaces of Saint Gobain. This result, interesting from a theoretical point of view, is also of importance in consideration of the practical industrial lessons that may be deduced therefrom.

According to the *Iron and Coal Trades Review*, a largely increased trade is now being developed in the waste slag of the basic steel works in Staffordshire, England. The demand for this product from German importers is extending rapidly, and they are buying up all available supplies. In England also the demand is increasing for fertilizing purposes. Slag, which was formerly sold at 2s. 6d. per ton is now realizing 25s. per ton.

The number of accidents in British collieries during the first half of 1891 was unusually small. The total number of persons killed by explosions of fire-damp was only 81, against 276 in the corresponding period in 1890, and 65 in the same time in in 1889.

Mechanical Science in Mining Engineering.

Mr. T. Foster Brown, C.E., in the course of an address before the British Association at Cardiff, said:—

In mining progress has been slow, and it is a remarkable fact that, with the exception of pumping, the machinery in use in connection with mining operations in Great Britain has not, in regard to economy, advanced so rapidly as has been the case in our manufactures and marine. This is probably due, in metalliferous mining, to the uncertain nature of the mineral deposits not affording any adequate security to adventurers that the increased cost of adopting improved appliances will be reimbursed; whilst in coal mining, the cheapness of fuel, the large proportion which manual labor bears to the total cost of producing coal, and the necessity for producing large outputs with the simplest appliances, explain, in some measure, the reluctance with which high-pressure steam compound engines, and other modes embracing the most modern and approved types of economising power, have been adopted. In the raising of coal from our mines and placing it on board ship in our docks there is a vast amount of machinery employed, much of which is now of an obsolete type. Where, however, new winnings have been made, or where in old mines it has been found necessary to replace the old machinery by new, the question of efficiency and, at the same time, economy in machinery has of late years received serious attention. The consideration of the question of economy in the employment of steam in coal mining operations has resulted in boilers of the most modern construction being erected, working to pressures varying from 80 lb. to 150 lb. per square inch, as compared with pressures varying from 40 lb. to 50. lb. per square inch in the old boilers, whilst the various engines are now being constructed on the most modern and improved principle. Compressed air has for many years been used extensively in our coal mines as a motive power. Electricity also has made rapid strides in the same direction; and I have no doubt that, in conjunction with a better type of machinery for the compression and use of air, will eventually become the principal agent in underground mechanical operations. I am, however, of opinion that there is still great room for improvement in electrical plant before it will be adopted in preference to other machinery now in general use, especially in gaseous mines, and these improvements must embrace a certain means of rendering sparking absolutely harmless under all conditions, for it involves not only the question of the increased efficiency of one class of machinery over another, but also the protection of human life. There must also be devised a ready means of reversing the power, so that the system of haulage known as the main-and-tail-rope system can be applied with equal safety and readiness in any part, as compared with absolute safety in the use of compressed air. Compressed air is another motive power largely used in coal mining, it being not only absolutely safe in gaseous atmospheres, but tending to reduce any danger which might exist from sudden outbursts of gas by assisting the ventilation. This may be considered as rather an expensive means of assisting ventilation; but it is very seldom that the air is used direct from the mains for this purpose. It is very doubtful, however, if in any compressed-air installation used in coal mining there is more than 30 per cent. of useful effect obtained; in many instances it is much less, as it is impossible in almost every case to heat the air after it has passed into the mine; and another source of loss is due to leakage, caused in great measure by the occasional upheaval of the ground disturbing the pipes. It is thus obvious that compressed air is more costly than electricity; but up to the present time it is the only absolutely safe power which is capable of being conveyed long distances underground in gaseous mines. In some of our coal fields very hard seams or veins of coal are met with, and various kinds of machinery have been devised to assist the coal hewer in severing the coal from the solid strata, and electrical appliances have in this class of machinery been more or less successful. It appears to me, however, that there is a want of simplicity about the majority of the machines which have come under my notice, which will operate against their general adoption. The cost of the conveyance of coal underground is a very considerable item in South Wales, probably amounting to £600,000 to £700,000 per annum, and consequently has caused great attention to be given to the subject. It has been found that the endless-rope system, where it can be conveniently applied, is the cheapest. This system, however, necessitates the laying and maintaining of either a double line of rails, or frequent passing points or loops, and as the nature of the strata does not always admit of the roads being made and maintained wide enough for this to be done, the main-and-tail system, which requires a single line of rails only, has in that event to be adopted. For endless-rope haulage the speed at which the trams or tubs travel is from 2 to 6 miles per hour, as against from 10 to 20 miles per hour by the main-and-tail system; thus there is much greater wear and tear in the latter than in the former. What is required is an absolutely safe and simple means of light haulage, made as portable as possible, so that it can be readily moved from one position to another, as circumstances may require, and arranged so as to replace the horses. Winding engines have of late years been very materially improved. Mechanical ventilation, by exhausting the air, has almost entirely superseded the furnace ventilation in general use many years ago, and which created a current by heat. Some of our coal mines are very heavily watered, and this involves large and costly pumping machinery, which takes various forms, the most generally used of which is, perhaps, the old-fashioned but economical Cornish vertical condensing steam engine, which, with its heavy rods and pumps, occupies a considerable portion of the room in the shaft. In recent years, however, there has been a tendency to apply the direct-acting forcing engine, fixed at the bottom of the shaft, of which there are various forms; and still more recently, pumps, worked by electrical power, are being brought into use, and in underground workings far away from the shafts this power seems eminently suitable, as the work in pumping required can be so regulated as to be constant, thereby reducing the risk of danger from sparking. Many excellent forms of direct-acting pumping engines have been designed, the most economical being the compound condensing direct-acting ram pump, which takes up little space. Perhaps the worst feature in adopting direct-acting pumps is the fact that steam must be conveyed down the shaft, which means a certain loss by condensation; a loss which can, however, be very materially reduced by having the steam pipes properly protected from exposure by suitable coverings. The steam and water pipes for this type of pump take up much less pit room than those of the Cornish pump, and this is of very great moment where the area of the shafts is limited. At the docks, also, the machinery for placing the coal on board ship has been greatly improved, so as to prevent breakage, one of the most recent improvements being the movable tip, which can be adjusted to suit the varying sizes of ships. Summarising the position of mechanical science, as applied to our coal mining industry in this country, it may be observed that there is a general awakening to the necessity of adopting, in the newer and deeper mines, more economical appliances. It is true that it would be impracticable, and probably unwise, to alter much of the existing machinery, but, by the adoption of the best-known types of electrical plant and air compression in our new and deep mines, the consumption of coal per horse power would be reduced, and the extra expense, due to natural causes, of producing minerals from greater depths would be substantially lessened. The consumption of coal at the collieries in Great Britain alone probably exceeds 10,000,000 tons per annum, and the consumption per horse power is probably not less than 6 lb. of coal, and it is not unreasonable to assume that, by the adoption of more efficient machinery than is at present in general use, at least one-half of the coal consumed could be saved. Much attention in modern times has been given to the relative values of the numerous new explosives which have been introduced for blasting in mines and for other purposes. As applied to mining, various experiments have from time to time been made for the purpose of testing how far it would be safe to employ these explosives in the atmosphere of a coal mine without the risk of causing an explosion of fire-damp. A number of these are mainly composed of compounds of nitro-glycerine with aluminous earth. But, whilst the experiments have indicated that, with rare exceptions, they are practically flameless, it is undoubted that one which would be absolutely so, and which could be used with safety in fiery mines, has yet to be produced. The adoption in our gaseous mines of a flameless explosive, a self-contained electric lamp of moderate weight, which will burn without attention for twelve hours, and the general application of water to moisten the dust, are all more or less questions in which the mechanical engineer is interested, and, when adopted, will probably have the effect of putting an end to the disastrous explosions accompanied by loss of life which occur at intervals in our fiery collieries.

Asbestos Discovered in Australia.

The following further particulars are given of this new and very valuable mineral discovery lately made at Broken Hill, which was announced recently in these columns. At the office of Messrs. Johnson Messent, may be seen a number of splendid samples of asbestos, of a quality superior to anything yet recorded in Australia. The locality of the discovery is Red Hill, about nine miles easterly from Broken Hill, in the Rockwell paddock where for a long time past Mr. R. Hinspeter, had been prospecting on the side of the hill, in which asbestiform rock was known to exist, and lately he struck a large vein of true amianthus, as the true Italian variety of this valuable mineral is called. The specimens on view are of great length, one being as much as 28 ins., and the staple ranges from a striated salmon-tinted variety, known as picrolite, from near the surface, to a beautiful snow-white flossy fibre of a considerable length and good tensile strength, taken from the shallow depth of 20 ft. while the material is now improving rapidly every foot. On the top of the hill, veins of coarse crysotile, the Canadian variety, are found in a ferruginous gangue of what appears to be chromic iron. Lower down a strong vein has been opened, while to the eastward is the deposit of amianthus, which seems of considerable extent. Stains of green carbonate of copper are plentiful, and both silver and gold in small quantities have been found on the property, a not unfrequent occurence in asbestos country. When it is understood that asbestos, for which there is an almost unlimited market in Europe and America, is worth up to £70 per ton, it will be seen that Mr. Hinspeter's discovery is one which will probably lead to the development of a new and profitable mining industry on our border, by which South Australia must benefit. At Gundagai, New South Wales, crysotile is being profitably worked by the Australian Asbestos Manufacturing Company; while at Broken Hill there is a market for picrolite, which is used for covering steam pipes, the asbestos clay being valuable in the making of fire-bricks.—*Exchange.*

The Early History and Progress of Coal Mining in Nova Scotia.

By John Rutherford, M,E., Stellarton N. S

(Written for the Review.)

It is always interesting to note the rise and progress of any industry the development of which is attended with an extension of commerce and a large employment of labor. The profitable investment of capital, the centralization of a large part of the population, and the consequent extension of the means of supply of its requirement, are such important elements in the growth of any country, that a record of the stages by which any branch of industry has advanced must be of general interest.

It is proposed to present in this article a sketch of the progress of one of the most important industries in Nova Scotia, viz: Coal Mining.

The period to be examined will cover a quarter of a century, but as this term is apt to give the impression of longevity, it will, perhaps, be better to call the retrospect one of twenty-five years' limitation. This length of time should surely be sufficient to place on a firm foundation any industry that possesses ordinary vitality. Let us see how the coal trade of Nova Scotia will bear this test. The initial point, however, in this inquiry may be placed a little further back, in order that the position of the coal mining operations, prior to the period embraced in the inquiry, may afford a more striking contrast with their present development.

Judge Haliburton,—Sam Slick—in his history of Nova Scotia, published in 1829, says: "A colliery has recently been opened in the Pictou district by Messrs. Rundell, Bridge & Co., of London, called the Albion colliery;" and the late Mr. Brown, of the Sydney mines, in his excellent work on the Coal Fields and Coal Trade of Cape Breton, states that coal was worked on the north side of Spanish River, the locality of the present Sydney mines, by the Government of Cape Breton in 1784.

These seem to be the earliest dates of any moment in connection with any regular mining operations. The conduction of these appears to have been steadily pursued in the case of the Albion mines, by Messrs. Rundell and Bridge, or rather by the General Mining Association, organized by them in 1825; and a like result followed the possession of the Sydney mines by the same company in 1827.

Coal mining remained in this, as it may be termed, limited form until 1858, when an agitation begun in 1845 against what was considered a monopoly of the mineral rights by the General Mining Association, resulted in an agreement between the Nova Scotia Government and the G. M. A., and, with certain reservations to the latter, the various coal fields in the Province of Nova Scotia and Cape Breton were free for exploration by other parties. Then was aroused the spirit of private enterprise; the explorer, in most cases a practical miner, shouldered his pick and began a search on the range at the outcrops of the seams of coal, or in localities which might be reasonably conjectured to contain the mineral sought for.

A rapid development of extended coal bearing area ensued, and an evidence of this progress is afforded in the report of the Chief Commissioner of Mines for the year 1864. According to that report, coal mining operations were being carried on at the "Albion" and "Fraser" mines in Pictou County, at four localities in Cumberland County, and at 16 mines in Cape Breton.

The production, however, was then of very limited extent in the aggregate. The Sydney, Lingan and Albion mines, the oldest mining establishments in the Province, contributing 314,355 tons of a total production of 429,351 tons in the nine months ending September the 30th, 1864—the then termination of the fiscal year. This is due to the fact of some of the mines being but partially opened, the operations in many cases consisting chiefly of the preliminary arrangements incidental to the laying out of the working places.

It is indicative, however, of the alacrity with which the search for coal was was pursued after the limits of the areas selected by the General Mining Association were defined; and in this connection it may not be out of place to suggest the question whether, as regards the expenditure of capital in starting new mines, the result has been of advantage or prejudicial to the interests of the Province. But apart from this question, there can be no doubt that the stimulus to exploration, under the circumstances referred to, has been of very great service in proving the extension of the various coal fields of the Province, and the existence of seams which, if inferred by geological deduction, were either ignored as unimportant, or, they had no place in the conceived ideas of the contents of the coal fields.

The freedom of search for coal in the unappropriated carboniferous regions was not allowed to remain in abeyance. The practical miner as well as the speculative investor was speedily at work; and it is of interest in this respect to note the indications of this flow of enterprise as shown by the records of the Department of Mines.

The report of the Chief Commissioner of Mines in 1863, is confined entirely to the more attractive metal—gold—and it was only in the following year that a statement is given which enables a comparison to be made in relation to the interest in exploration above referred to. The amount received by the Department during the nine months ending September 30, 1864, for licenses to search for minerals "other than gold," was $2,420, and for licenses to work $300, making a total of $2,720.

It may here be explained that the legislative enactment with respect to mineral explorations was that a license to search for minerals other than gold could be obtained on payment of twenty dollars: this gave a right of search over five square miles, and was in force for one year. The holder of the license was entitled to a license to work one square mile if he applied for it and defined its bounds; but he was not restricted to the one square mile, but could cover the entire ground by consecutive rights on payment of the specified fees. The license to work was of two years' duration, and under certain regulations the areas could then be held under lease.

While on this part of the subject it may be stated that the same arrangement as regards the respective rights of search and to work and obtain a lease is in force at present, with the additional privilege that the holder of a license to work may have the time extended to three years on payment of one half of the amount originally paid for such license.

In this connection it is interesting to note the indications of the spirit of research and the variableness that prevailed in subsequent years. As stated above, the amount paid for licenses to search for and work minerals "other than gold" in the year 1864, was $2,720. The following statement shows the amount received by the Department of Mines for licenses from 1865 to 1886, inclusive:—

	Licenses to search.	Licenses to work.
Twelve months ending Sept. 30, 1865..	$10,400	$1,650
" " " " 1866..	7,520	3,450
" " " " 1867..	2,980	2,450
Three months ending Dec. 31, 1867....	760	300
Twelve months ending Dec. 31, 1868..	2,880	950
" " " " 1869..	3,160	1,200
" " " " 1870..	2,680	650
" " " " 1871..	2,647	852
" " " " 1872..	6,179	2,626
" " " " 1873..	6,840	2,850
" " " " 1874..	4,880	2,825
" " " " 1875..	3,480	2,025
" " " " 1876..	3,280	1,250
" " " " 1877..	1,800	775
" " " " 1878..	1,420	625
" " " " 1879..	1,240	325
" " " " 1880..	3,360	550
" " " " 1881..	4,560	800
" " " " 1882..	5,180	1,925
" " " " 1883..	3,180	1,150
" " " " 1884..	1,940	1,050
" " " " 1885..	1,820	750
" " " " 1886..	2,980	500

These figures exhibit a fairly steady continuance of the energy with which explorations were pursued. Of course the licenses include other minerals than coal, but those for coal constitute very much the larger proportion of the different quests. It will be observed that the largest payments were in the years 1865-6. The discovery of new seams and their partial opening in the different localities, stirred up the desire for the discovery of others, and explorations were actively carried on in these years. In the following years, up to the end of 1871, the stimulus seems to have abated, but in 1872-3—years in which the coal trade generally experienced an extraordinary period of prosperity—a rush is again evident in the ranks of explorers and the licenses approach in the amount of payments to those in the year 1866. Let us now see what was the result of these explorations in the different coal fields.

Beginning with the Pictou coal field—in 1864 the Albion mines was the only mining establishment in that County, and some idea of the extent of the operations may be gathered from the statement that in the year 1863 the shipments were 198,313 tons. In the following year, 1865, other five mining localities are named in the Commissioner's report, at which coal was being mined. The position of these openings in relation to the Albion mines area is indicative of the shrewdness with which the explorations were made. In an east and west direction—the range of the outcrop of the seams from these respective boundaries of the Albion mines area, as well as in the direction of the outcrop to the south thereof—seams of coal were traced and opened on, and the expansion of the coal field was thus developed to an extent which might have been surmised, but had not received the definiteness thus given to it.

A like result attended the search for coal in Cape Breton. In that coal field the outcrops of the seams are in many cases in the cliffs bordering the sea shore, and they were, to a certain extent, a guide of the probable shape of their deposition: yet here, as in other localities, it would seem that the expansion of the coal bearing strata has been on a much larger scale than the geological knowledge of the period we are dealing with appears to have suggested.

In Cumberland County the operations were confined to the Joggins shore on an area held by the General Mining Association, and, as at the Albion and Sydney mines, the locality was one of the earliest worked in the Province, though on a small scale, the sales of coal in 1851 being only 2,400 chaldrons, or 3,600 tons. In 1864 the sales were 6,053 tons, and in 1866, 8,478 tons.

We may now consider what the position of the coal mines was, in a general point of view, at the commencement of the period under review.

The report of the Commissioner of Mines for the year 1865, shows that there were in that year six mines, or openings on seams of coal, in Cumberland County, six in Pictou County, and eighteen in Cape Breton.

The output at some of these openings was on a very small scale; they were in many cases but the exploratory operations, and were not then fitted with the necessary means of production.

The fiscal year at that time terminated on September 30th of each year; but, as the statement gives a year's production it will not affect the comparison with subsequent years.

In the year ending Sept. 30, 1865, then, these thirty mines, so-called, gave a production of 712,574 tons of coal. Taking a decennial period for comparison, there were in the year 1875 the same number of mines in operation in each county as in 1865, but the production was only increased 68,591 tons. In the year 1885, twenty seven places of production are named; nine in Cumberland, five in Pictou and thirteen in Cape Breton, and the total output was 1,352,203 tons; an increase of 571,038 tons, or 73% on the production of 1875. In the next five years the increase at the end of that period, viz., Dec., 1890, is 631,798 tons, the total production being 1,984,000 tons, while the number of mines in Cumberland County is reduced to three, in Pictou to four, and in Cape Breton to ten.

The fluctuation in the number of the mines is due to various causes. In some cases a misapplication of capital in the equipment of the mines under adverse circumstances, or position of the openings; in others the too rapid development of the different seams of coal as regards the requirement of the coal trade; a lack of railway accommodation and convenient and safe shipping places; these led to the abandonment entirely of some of the operations and to a suspension of some others.

It may now be interesting to note the progress and the direction of the expansion of the coal trade over the period under review. A like decennial comparison as in the case of the production will perhaps be sufficient for this purpose.

The classification of the sales of coal is not given in the early reports of the Chief Commissioner of Mines, with the same detail as at present, and the comparison for the ten years, 1865-1875, cannot therefore be given with the same minuteness with respect to the localities as in the subsequent periods.

In the year ending Sept. 30, 1865, the sales are summarized under the heads of "Home Consumption," "Neighbouring Colonies," and "Other Countries," and they are in this rotation as follows: "Home Consumption," 59,536 tons; exported to "Neighbouring Colonies," 52,561 tons; and exported to "Other Countries" 338,756 tons. Generalizing in the same way, the respective sales in 1875 stand, as in the above order, 212,630, 381,711, and 112,454 tons. In the year 1885 the sales are 444,652, 769,643 and 40,215 tons; the comparison standing thus:—

	Home Consumption. — Tons.	Neighbouring Colonies. — Tons.	Other Countries. — Tons.
1865.....	59,536	52,561	338,756
1875.....	212,630	381,711	112,454
1885.....	444,652	769,643	40,215

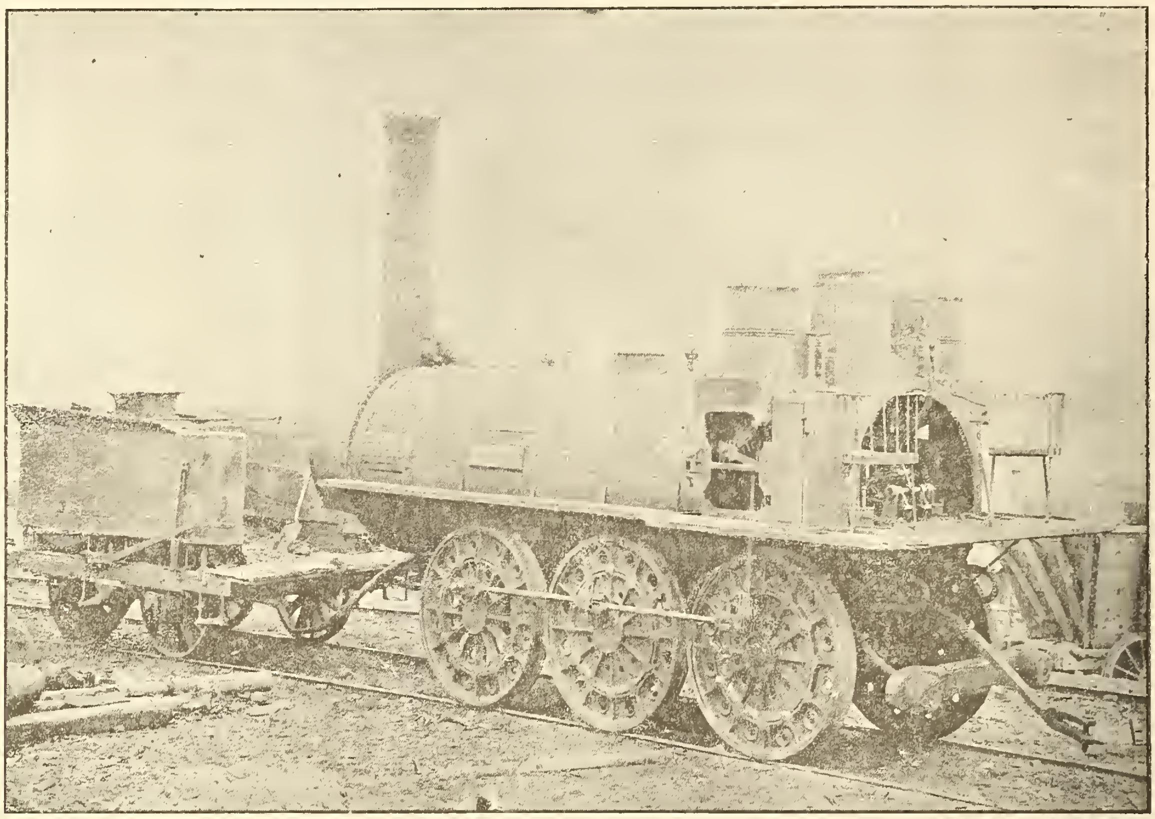
These are remarkable figures, and are worthy of comment on their indication of the expansion of the trade. In 1865 the general position was this: Both the local or home consumption and the sales to neighbouring colonies were but of small extent—a little over 112,000 tons. The sales to other countries may be said to have consisted almost entirely of those to the United States—the Reciprocity treaty being then in force. The entire trade may be said to have been done by shipping. The Intercolonial railway, or as it was then termed, the Nova Scotia railway, had its inland terminus at Truro; and had thus no connection with any mining locality. The provinces were not then federated, and Quebec and Montreal drew their principal supply of coal from the United States.

In 1875 all this was changed. The abrogation of the Reciprocity treaty by the United States Government, and the imposition of a prohibitory duty of $1.25 per ton, seriously affected the coal trade with that country. The construction of the Intercolonial railway opened a connection with the growing towns on its route and developed an increasing demand for coal as well as for its own requirements; and a trade by water with the Province of Quebec sprung up and has steadily grown.

It is interesting in this connection to note the direction of the radii of increase, but, for the reason already given, the examination can only be made in the second term of the period, viz: from 1875 to 1885. Their relationship stands thus:—

Sales to	1875. — Tons.	1885, — Tons.	and in 1890. — Tons.
Nova Scotia......	212,630	444,652	601,946
Quebec..........	189,754	493,917	751,931
New Brunswick...	85,968	48,634	224,786
Newfoundland.....	62,348	74,322	96,133
Prince Ed. Island.	43,641	52,770	55,843
United States.....	89,746	34,483	50,754
Other countries...	22,708	5,732	4,718

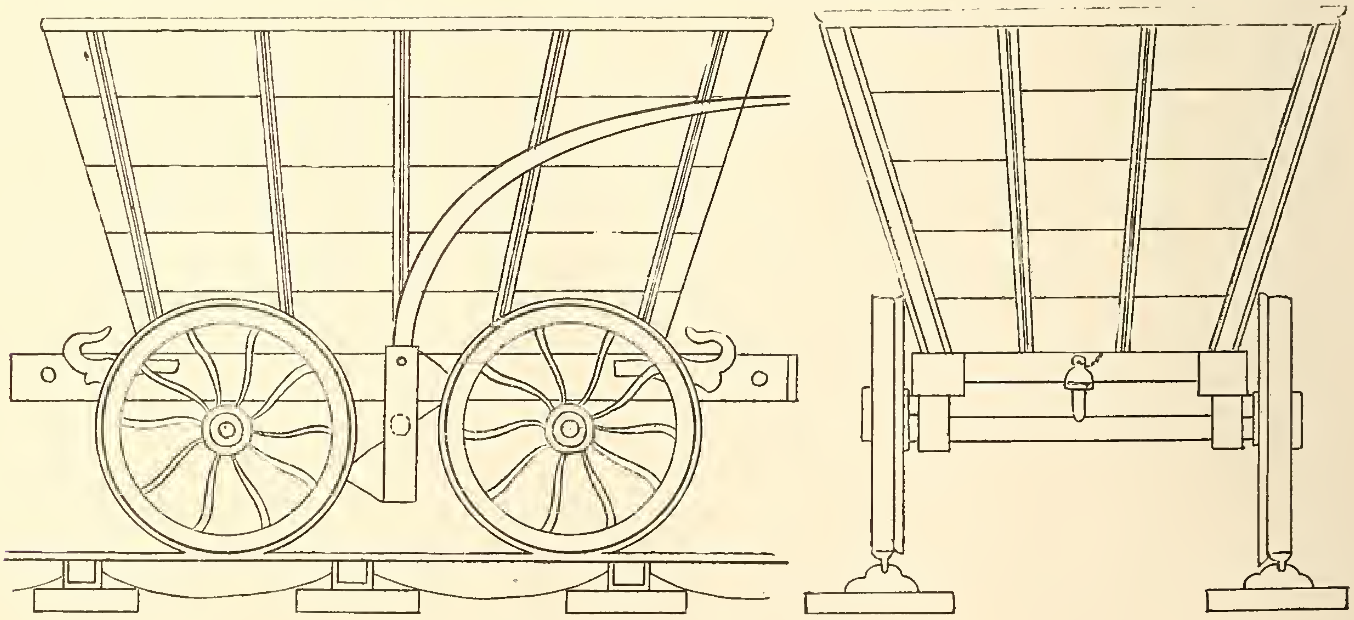
What is to be gathered from these highly interesting figures? The very gratifying fact that the home or local trade, generally the best, has grown largely and is still healthily progressing, as the figures for 1890 satisfactorily show. The expression "a gratifying fact" may be fairly used in consideration of the circumstances whence it has its origination. In the first place it augurs well for the future of coal mining in Nova Scotia that the use of coal is displacing the use of wood for fuel; and that railway communication is being extended throughout the province in various localities and affording the means of access to comparatively secluded towns and villages. Then, this expansion of the sources of demand necessitates an increased output or production of coal, one of, and indeed the chief, elements affecting the cost of production. A good home trade enables the surplus production to be more advantageously placed in other markets. Having thus briefly sketched the progress of the coal trade of Nova Scotia, as regards the production and sales, a few remarks may not be out of place on the adoption that has become necessary of the improved means of output whereby this extension of the demand has had to be met.



THE OLD HACKWORTH LOCOMOTIVE AT THE ALBION COLLIERY.

The crude application, for such indeed it may be termed, of machinery in the early stages of Nova Scotia coal mining—not excepting even that of the General Mining Association, for their appliances were somewhat old-fashioned—could not, under the changing circumstances of the trade in the direction above described, long remain unaltered. The adoption of more powerful hoisting engines, a better equipment of the means of preparing the coal for market and the substitution of steam power in the place of horses in the underground haulage, the drainage and ventilation of the mines—all forced themselves on the managerial consideration and have educed a position in these respects that may be favorably compared with the higher stage of mining appliances in older coal producing localities.

A brief description of the appliances at the Albion and Sydney mines of the General Mining Association will best illustrate the condition in this respect prior to the period under review, and the present means of dealing with the requirements of the trade. It is unnecessary to describe those of both because they were, as they still are, alike in most respects.



THE NEWCASTLE CHALDRON WAGGON.

The hoisting engines were of the class more generally used for driving machinery; beam, fly-wheel, etc., being the characteristic feature, or with overhead drum or rope roll of Crowther's engine, a form of application which possesses considerable merit inasmuch as the lead of the rope is in a higher position and lessens the bend thereof. The drainage or pumping was effected by lifting pumps worked by the same engine by lever or V bob application; and the ventilation was accomplished by the aid of a furnace underground.

On the surface the screens were short and adapted rather to enable any impurity in the coal to be picked out than to abstract the smaller portion of the coal. The steam was raised in the old fashioned egg ended boilers with flash flues, and a considerable number were required with a corresponding large consumption of coal; and the transference of the loaded waggons into which the coal was put at the screens, was effected by the use of locomotives of what may now be not unfairly termed an antique type. The subjoined illustration is from a photo of one of these engines, and it is especially interesting, not only on account of its peculiar construction, but also from the fact of its builder, Timothy Hackworth, having been one of the competitors in the celebrated trial of locomotive power on the Manchester and Liverpool railway in 1829, on which occasion his engine—the Sans Pareil—was admitted to possess features of construction of considerable merit.

The locomotive of which an illustration is given, was built by Mr. Hackworth in 1838, and has been in use at the Albion mines up to so late a period as the year 1885.

In addition to the interest in this locomotive arising from the preceding statement, is the fact of its being the oldest, but one, in America. It was exhibited at the Chicago exhibition and was then awarded this position as regards seniority. One of its peculiarities deserves special mention. The wheels are of cast iron and composed of two parts, a centre or axle piece and an outer portion to which the tyre is attached; the connection between the two pieces of the wheel being made and held tight by wooden pins, driven into the circular sides formed by the junction of the inner and outer pieces.

Another old fashioned adoption in use at these mines, is the vehicle of transportation of the coal from the mine to the shipping wharf; this is the Newcastle chaldron waggon, a sketch of which is given.

Its capacity was ordinarily reckoned 53 cwt., but by the addition of a narrow board on the top of the sides and ends, it will hold three tons. The shape is assumed to give freedom of discharge, but the mechanical structure cannot be considered of the best form. It, however, as well as the fish-bellied rail of cast iron, the stone blocks on which the metal chairs were placed, and the wooden keys to hold the rail in place, all have had their day; and as in the case of the hoisting, pumping and traction engines, a new type has displaced them, and, as regards the mines to which the preceding description refers, an application of the modern and very superior form of engine power for each of these purposes has been adopted.

One of the usual results of the extension of the workings in the mine has had development in these localities in which a large output of coal has become necessary: that is the application of steam power for underground haulage. The writer is not aware of any special peculiarity in Nova Scotian mines in this respect, but it is an evidence of the growth of mining appliances and of the importance of mining officials of all grades watching keenly the scientific adaptations of older mining localities. The keen competition in the trade demands a managerial watchfulness of every appliance of whatever object it may be in connection with mining.

Having thus sketched the productive progress, let us now note that which is of especial importance in connection with the mining operations.

A comparatively small space of workings and a freedom from the coal miner's *bete noir*, explosive gas, is apt in the first operations to induce an indifference with respect to the provision of a ventilation or supply of fresh air necessary for the miner's health, irrespective of that required when gas is exuded in a quantity sufficient to render the working place unsafe.

A consideration of the circumstances in which many of the mines, opened on the outcrop of the seams, were situated in the first openings, is to some extent, an excuse for this indifference. The absence of gas of any importance—in some cases the entire freedom from it—and the natural tendency of the air to pass into the workings where the temperature was higher than that outside, together with, in some cases, the means of exit in a favorable position, seemed to beget the idea that little more was required than to allow the air to take its own course through the mine and leave when it liked. An illustration of this idea may be mentioned, which was by no means a single instance of this belief in natural ventilation, so called. The writer on one occasion put some questions to the person who superintended the underground operations relative to the ventilation, and sought to ascertain whether any idea existed with respect to an organized arrangement of the conduction of the air through the working places. After passing through these, and when scarcely a movement of the air was perceptible, the question was put: "Which way does it go now?" "Oh! it goes out," was the reply. "Where?" was asked, "let us follow it." This was done so far as the assumed route was followed, but not the slightest bend of the flame of the light carried could be observed. "Why there is none here; what has become of it?" was asked. "No, it has gone out," was the inferred reply from the confused statement of opinion on this all-important point.

It will not be a matter of surprise, in view of the preceding, that in many cases the opening of a coal mine was undertaken by persons who had little knowledge of mining beyond the cutting of the coal and such general ideas as an observing and reflective disposition might suggest with respect to the means of ventilation.

As the operations extended and the workings began to approach a gas yielding position the adoption of artificial means of ventilation became necessary, and the liability to trouble from its neglect became evident. The position of the Inspector of Mines at the period now referred to was not that of the official of the present day. He was not armed with any power to compel the adoption of what he might consider necessary in order to a safe carrying on of the operations; nor indeed could it be considered an absolute necessity in the early stages of the opening of the mines. Under the circumstances, with respect to freedom from gas and the very limited extent of the operations, it was not considered necessary to impose what might be thought to be a restrictive measure at that time; the Inspector suggested and recommended improvements, and in most cases they were received in a satisfactory manner. The time came, however, when an enforced system was necessary, and it is to the credit of Mr. Poole, the then inspector, that he was instrumental in inducing the Government to pass a Mines Regulation Act, the terms of which are based on those of the English Act for a like purpose.

The system of mining, which has been generally adopted is that known as the bord and pillar. Take as an illustration the starting point of the commencement of a slope driven from the crop. It is driven in the direction of the fall dip of the seam far enough to allow a goodly strip of solid coal between the levels—to be driven on that course from the slope—and the crop. At regular distances in the level, places are worked to the rise out of which bords are turned and driven, in the level direction, at such distances apart from each other as circumstances may render it expedient to adopt. Communication is made between the bords for ventilation and other purposes, and thus detached blocks of coal are formed which are termed pillars—their object in the first working, as it is called, being indicated by the name.

They are after a time removed and the roof or superincumbent strata falls into the excavated space and forms the roof. Of course this description applies to seams whose deposition is comparatively flat as well as to those at various angles of dip. Sundry attempts at long-wall working have been made, and it is not improbable that this system will come into greater use than has hitherto prevailed. There are so many circumstances that have to be taken into account before it can be beneficially adopted, that those who have had practical experience of the system are best able to decide on the fitness of its application.

A brief sketch has now been given of the progress and development of the Nova Scotia mines in both a commercial and mining point of view. A few particulars in connection with the general operations are added which may be of interest. The statements given in the Annual Reports of the Department of Mines furnish the data on which the following comparisons are made.

With respect to the number of persons employed, the classification of underground and above ground is taken in its general sense without regard to this division of labour.

In the year ending September 30, 1865, the persons employed at all the mines numbered 3,043; in the year ending Dec. 31, 1890, the number is 5,324.

The average quantity of coal used on the mines by engines and workmen is, in Cumberland County, 7% of the quantity raised, equal to 160 lbs. per ton of coal raised, and of this quantity 76% was used by engines and 24% by workmen. In Pictou County the figures are over 9%, or 224 lbs. per ton of coal raised, of which engines used 78% and workmen 22%; and in Cape Breton the average is a little over 9%, being 215 pounds per ton of coal raised, of which engines used 64% and workmen 36%. The average number of tons of coal cut per day by the cutters is, in Cumberland County, 2·6 tons; in Pictou, 3·3 tons; and in Cape Breton, 3·9 tons.

Having taken this brief retrospect of the coal trade of Nova Scotia, embracing the mode of conducting the operations, and the extension of the trade in a general point of view, it may not be out of place to glance prospectively at its future. Not possessing the dangerous gift of prophecy the writer is sensible that he is approaching a delicate part of his subject, and holding in respect as he does the old saying that "discretion is the better part of valor," he will not venture further than to express a firm belief in the future as regards the mineral wealth of this wonderfully enriched province in this respect.

The schemes of speculators may subserve their immediate interest, although lacking the essentials of success, but even they tend to develop resources which might otherwise remain dormant.

It may be more within his ken to strongly urge the adoption of assured improvements in mining machinery and economical and safe appliances; the extension of the scientific knowledge that must be the foundation of that grade aimed at by those workmen who possess the praiseworthy ambition to fill a higher position and to contribute by the application of practical skill conjointly with that knowledge, to the healthy and wealthy advancement of one of the most important branches of industry.

Notes on Mining Explosives.*

By Mr. Charles Cockson.

At the January meeting of this Society, during a discussion on a paper read by Mr. James Grundy, one of Her Majesty's Inspectors of Mines, the writer promised to prepare some notes on the electrical firing of mining explosives. On further consideration it occurred to him that a more general paper on the question of explosives used in mining would be of more interest to the members than would be one dealing only with the minor but at the same time most important matter of the best means of firing such explosives. He felt that this extension of the subject was allowable, because at the time at which this paper was promised considerable difficulty was being experienced by some users of electrical detonators in the Wigan and other districts by occasional miss-fires, and the writer was confident that such difficulties were due to some temporary defect in the manufacture of some portion of the detonator or the connecting wires, and he thought that in the investigation that was then being made as to the cause of these difficulties some points of interest would transpire that might with advantage form a portion of this paper. This has not, however, proved to be the case; the only result of the investigation having been that the manufacturers of the electrical detonators referred to have ascertained the exact cause of the occasional miss-fires which for some couple of weeks or so had tried the patience of the users, and, as far as the writer's experience goes, there is now no cause of complaint, the proportion of miss-shots at the collieries with which he is connected having been only 1·17 per thousand during the last six months, with the exception of the two weeks at the beginning of January. This figure, which includes miss-fires from causes other than defects of manufacture, compares most favourably with the system of firing by ordinary fuse, and convinces him that there are no real disadvantages, and he thinks no very great difficulties in the adoption of electrical firing, the advantages of the latter system being so great as to make the small additional cost or trouble matters hardly worth considering. Before describing what, in the writer's opinion, should be the essential qualities of a safe explosive for the use in coal mines, it would be well to give a *resume* of the conclusions and recommendations of the various Government Commissions that have investigated the question, and also to note the various official recommendations and reports that have been made subsequent to the passing of the Mines Act of 1887. We shall be then better able to discuss the merits and faults of some typical explosives of the various classes now being manufactured and used in this country. The question of rendering safe the use of explosives in fiery mines has been investigated by Government Commissions in England, France, Austria, Prussia and Saxony. In this country the Accidents in Mines Commission was appointed in 1876, and issued their final report in 1886, and their conclusions were as follows (p. 48); "1. The occurrence of a blown-out shot in working places where very highly inflammable coal dust exists in great abundance, may even in the total absence of fire-damp possibly give rise to violent explosions, or may at any rate be followed by the propagation of flame through very considerable areas, and even by the communication of flame to distant parts of the workings where explosive gas mixtures or dust deposits in association with non-explosive gas mixtures exist. 2. The occurrence of a blown-out shot in localities where only a small proportion of fire-damp exists in the air, in the presence of even comparatively slightly-inflammable or actually non-inflammable, but very fine, dry, and porous dusts, may give rise to explosions, etc." They consequently recommended as the only possible means of guarding against the occurrence of explosions from shot-firing—1. The removal of dust as completely as possible from the working places. 2. The provision and thoroughly efficient adoption of simple and effectual measures for rendering dust innocuous in the presence of a blown-out shot. 3. The discovery of means for preventing the possible occurrence of blown-out shots. 4. The adoption of particular explosive agents or particular methods of using such agents which deprive blown-out shots of their danger by ensuring the total absence of flame, or of highly heated solid matter when the shot is fired. 5. The substitution for explosive agents of similarly efficient methods of bringing down coal and stone, which are quite free from the special dangers attending the use of those agents. The committee also recommended that the use of powder should be prohibited in fiery and dusty mines, unless the dust be removed as completely as practicable from the vicinity of the place where the shot is to be fired, such removal to be followed by a copious watering of the face and the place. They also recommended the substitution for powder in dry and dusty mines of one of the then known high explosives, in conjunction with the water cartridge and electrical firing. Taking their recommendations seratim, subsequent experience has, in the writer's opinion, proved the following: 1. The thorough removal of dust is impossible as a practical safeguard. 2. The rendering dust innocuous by watering or chemical agents is expensive and impracticable, and inadvisable in many mines. 3. No means have yet been discovered to prevent blown-out shots. 4. The use of compressed air and lime cartridges have both proved failures, and no mechanical appliance has yet been devised that can do the work of explosives either as safely or as economically. 5. The only recommendation of the Commissioners left is the use of such an explosive, or such a method of firing an explosive as deprives a blown-out shot of its danger. In the writer's opinion this recommendation is now perfectly practical and feasible, and should be enforced by the Government in all coal mines in which fire-damp is given off, or which are dry and dusty. It was not until after the report of the English Commissioners had been presented, that anything had been done in this country, beyond laboratory experiments, in the direction of finding an explosive whose composition would in itself be such as to deprive blown-out shots of their danger, hence no mention is made of any of the so-called safety explosives which are now in considerable use in British and foreign mines. The French Commission on the use of explosives in mines presented a most voluminous report, in July, 1888, and in consequence of their recommendation, on August 1st, 1890, the French Minister of Works issued a decree applying to all fiery mines, or mines in which the dust is inflammable. 1. Prohibiting the use of blasting powder. 2. Prohibiting the use of explosives whose products of detonation contain any combustible matter, such as solid carbon, or hydrogen and carbon-mon-oxide gas. 3. Prohibiting a less length of stemming than 20 inches, such stemming to be of plastic matter. The reports of the Austrian and Prussian Commissions, speaking generally, condemn the use of gunpowder and ordinary fuse-firing. In this country, the Mines Act of 1887 contains much more stringent regulations than did the Act of 1872, doubtless they are so well known to all of you that their repetition here would be a waste of time. Since the passing of the Mines Act of 1884, circulars have been sent out by Her Majesty's Inspector of Mines in this district, in January, 1889, calling attention to special rule 73, by which the use of gunpowder is prohibited in any ventilating district of a mine in which inflammable gas has been found during any of the last four previous recorded inspections by the Freman; and in September, 1890, disallowing the use of roburite as a non-inflammable explosive if fired by ordinary fuse, and recommending electrical firing; in December, 1890, the Home Secretary issued an important minute on the question of coal dust, accompanied by a detailed report of Mr. Hall's on the experiments in this district, which he had carried out on a large scale to test to what extent colliery explosions may be caused by blasting with gunpowder in colliery workings which are dry and dusty, and in the entire absence of fire-damp. In these experiments, for which the thanks of the mining community are due both to the Home Secretary and Mr. Hall, it was established that a violent explosion could be caused by a blow out shot in the presence of coal dust and the entire absence of fire-damp, Mr. Hall stating that at experiments at the Big Lady Pit "such flame travelled more than 200 yards, and only ceased when it reached the mouth of the pit, and there was an undoubted increase of violence as it travelled on its course." The Home Secretary, in his minute, urges the prevention of the accumulation of dry coal dust; the abolition of the use of gunpowder, except when all the workmen have been withdrawn from the seam, and the adoption of the best means at present known for preventing, or at least mitigating such disasters as have recently occurred. Her Majesty's Government subsequently appointed a Royal Commission to investigate the question, and their detailed report will doubtless be of much interest, and in my opinion will certainly confirm the conclusions arrived at by Mr. Hall. Taking as our standard of perfection such an explosive as cannot cause in actual use in the mine an explosion of either fire-damp or coal dust, we may reasonably divide the explosive agents now in use in coal mines into three classes. 1. The non-safety class. 2. The water-cartridge class, or safety tamping class. 3. The Safety, or so-called "Flameless" explosives. 1. *The Non-Safety Class*—In this class we must place gunpowder, both ordinary and compressed, dynamite, gelignite, and tonite, unless they are used with the water or other safety tamping. Of these gunpowder is the most dangerous, because it cannot be made safe in the presence of fire-damp or coal dust even by water tamping or any such analagous device. (Mines Commission final report, p. 53). Also the flame of a powder shot, although not from a blow-out shot, is sufficient to produce an explosion. The result of numerous experiments with mixture of inflammable gas and coal dust alone, witnessed by the writer, proves that a blown-out powder-shot will almost invariably produce an explosion. It can only be a question of a year or two before the use of powder must be abolished in all fiery or dusty mines. 2. *The Water-Cartridge or Safety Tamping Class*—In this class the writer includes a high explosive used with either (1) Dr. McNab's water tamping, (2) Galloway's moss and water tamping, (3) Settle's water cartridge, (4) Heath and Frost's gelatinous cartridge, (5) tonite used with Trench's fire-extinguishing compound, (6) coal securite used with the Securite Company's flameless cartridge case. To Dr. McNab should be given the credit of first using water tamping with the object of lessening the loss of time caused by powder smoke in mining work, and also with the idea of quenching the flame. This system was never largely adopted, the gun in which the explosive and water tamping was placed being an unnecessarily cumbersome arrangement. Mr. Galloway suggested the use of a high explosive tamped with moss, saturated with water. Mr. Miles Settle's water cartridge is an adaptation of Sir Frederick Abel's idea of water tamping, which appears to be the best arrangement of effective water tamping. Heath and Frost's gelatinous cartridge is intended to have the same effect as the water cartridge, but with a lesser risk of the tamping becoming inoperative by leakage of water through breaks in the water cartridge or coal. The Galloway, Settle, or Heath and Frost's systems of firing shots in mines if carefully carried out with suitable high explosives and electrical firing and the protecting tamping in each case properly proportioned to the charge of explosives used, may be said to be practically free from risk of causing an explosion with a normal charge of explosive. The objection to all these systems are mainly: 1. The increased guage and cost of bore-hole required for each shot. 2. The tamping detracts from the power and useful work that can be done by the explosive. 3. There is a constant risk of workmen, through forgetfulness or other reasons, neglecting to use the protective tamping properly, in which case the fancied security of the system may lead to disastrous results—as shown at the Apedale Colliery explosion last month, when ten lives were lost. *Trench's Compound with Tonite*—This system is open to all the objections above named, and the writer has experimentally caused gas explosions with the blown-out shots of six ounces of tonite tamped with six inches of Trench's compound—the tonite, however, not being surrounded with the compound. *Securite*—The writer has not tried this explosive with the Securite Company's flameless cartridge case, which consists of a flannel bag prepared with chemicals, which requires to be immersed in water shortly before use. Without this protection he has repeatedly seen gas and dust explosions experimentally produced by a blown-out coal securite shot. 2. *The Safety or So-called Flameless Explosives*—In this country the explosive of this class, which is best known and has established its name as being a thoroughly safe explosive, is roburite. Of other explosives now being manufactured abroad with the same object in view, the writer has not yet been able to make sufficient experiments to allow of his classifying them; but so far as he has gone he has found as yet no explosive which is equal to roburite from the point of view of either safety or economy. This explosive was brought before the notice of this Society in a paper read by Mr. James Hilton some two years ago. The result of another two years' experience has been to confirm all that Mr. Hilton said in favour of the explosive, which is now being sent away of regular quality, free from any defects, at the rate of considerably over a ton a day. Mr. Hilton described the method of using the explosive and the precautions required for electric firing, so that it is needless for me to do more than deal with a few matters that have transpired since his paper. Referring to the question of fumes from the explosion of roburite, the committee of experts appointed by the owners and workmen at Park Lane Colliery thoroughly investigated the matter, and their report was most satisfactory to users of roburite, their decision being that "if proper care is exercised the use of roburite will not add to the harmful conditions under which the miner works," as summarised by the Home Secretary, in reply to a question in the House of Commons, when he also said "it is a useful explosive and practically safe for use in fiery mines." In September, 1889, a joint committee of the Durham Owners' and Miners' Associations was appointed to enquire into the question of both roburite and tonite fumes, and although their report is not yet printed, the writer understands it refers most favourably to roburite. In August, 1889, the members of the Lancashire Branch of the National Association of Colliery Managers visited the Roburite Company's works, near Wigan, and, themselves made a series of tests with blown-out shots, when they were unable to fire an explosive mixture of gas, although gunpowder and tonite fired it under the same conditions. It should also be noted that Mr. Hall, in his recent coal dust experiments, found that roburite did not fire a mixture of coal dust and air, and in his report says: "Some experiments were tried with roburite shots, and these failed to explode the dust; but although I think the experience of the experiments went to show that a large flame, such as is given off by a blown-out gunpowder shot or a local explosion of fire-damp, is required to ignite dust, yet further tests of the high explosives, such as roburite, seem desirable before they can be pronounced actually free from danger in the presence of coal dust." Within the last week or two the writer has witnessed a series of experiments where blown-out shots have been fired into a mixture of coal dust and air, in the absence of inflammable gas, the results of which were as follows, using four ounces of explosive in each case: Roburite did not fire the dust when tamped with four inches of coal dust. Under the same conditions both coal securite, tonite, and gelignite caused an explosion of the dust, which burnt fiercely for some seconds after its ignition. These experiments were made on two different days, and on the second day were witnessed by Mr. Hall, on which day tonite did not fire the dust during a trial of three tamped shots, although it had done so two days previously on a very wet day, when one would think the dust mixture would have been less liable to ignition. In the writer's opinion the essential qualities of a safe explosive for use in coal mines are: 1st. It should be incapable of exploding accidentally by concussion, pressure, friction, fire, or lightning. 2nd. A blown-out shot should not fire an explosive mixture of either coal dust or fire-damp, and the explosive should have this property under all conditions that may be met with in ordinary use, and without the addition of anything but the ordinary tamping, which is necessary to develop the useful effect of the explosive. 3rd. It should not, when detonated, produce any combustible or inflammable gases. 4th. It should be of such a composition that it will not affect the health of workmen if used with due care. 5th. It should be unaffected by frost or variations of temperature. In conclusion, the writer would submit that these qualities are all possessed by roburite; in addition it is for coal work almost as cheap as gunpowder, and in nearly all mines is as effective as powder in getting the coal down in good condition, while for roof-blowing and metal work the writer is convinced that it is quite as cheap, if not cheaper, than powder.

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* Read before the Manchester Geological Society.

Asbestos Mines to Close Down—Mercier's Mining Act Begins to Bear Fruit.

An important meeting of the mine owners and representatives of the companies operating asbestos mines in the Thetford and Black Lake districts, was held in the Club House, Black Lake, on Thursday evening, 24th Sept. Among others present were: Hon. George Irvine, Q.C., (president Johnson's Co.); Col. Lucke, (Beaver Co.); E. Wertheim (American Co.); James King, (King Bros.); John Johnson, S. J. Johnson, Alfred Ward, Robert Ward, Peter Ward, Tom Sheridan, (Bell's Asbestos Co.); Matthew Penhale, (Glasgow and Montreal Co.); A. S. Johnson, M.P.P., A. H. Murphy, (Thetford Mining Co.); G. M. Melville, (White's Co.); L. A. Klein, John J. Penhale, (United Co.); A. M. Evans, B. T. A. Bell. Hon. George Irvine, Q.C., was elected chairman, and Mr. B. T. A. Bell, secretary. The proceedings were private. It is understood, however, that the subject mainly under discussion was the relation of the crude asbestos trade to the Mercier Mining Tax. The outcome of a long session was the following resolution adopted unanimously:

"In view of the circular letter of Mr. Antoine Taschereau, Inspector of the St. Francois district, announcing the intention of the provincial Government to enforce the provisions of the new mining act "*with the utmost rigor of the law*," we, the asbestos owners and operators of Thetford and Black Lake, do hereby resolve to close down our mines from 1st November until further notice." The resolution was signed by all the companies represented at the meeting.

* * *

Steel Car Wheel Test.—A very practical test recently made in Boston of the strength and serviceable qualities of steel car wheels would seem to leave no room for doubt as to their superior value. A 33 inch car wheel of this description was placed on two solid iron blocks, with the rim resting on each block. Under this arrangement a weight of 525 pounds, falling from a height of 17 feet, struck the hub 25 times, without any effect other than battering the metal. It was then dropped 10 times on the rim without a fracture. Next, a weight of 1400 pounds was tried, falling from a height of 17 feet, and striking the wheel 11 times, but failing to break it, thus showing it to be practically indestructible under even extraordinary circumstances. At another series of experiments, in order to determine the expansion and contraction of the metal, a wheel was buried in sand and a charcoal fire built around the tread until it was brought to red heat; then it was taken out and exposed to the atmosphere, which had no effect on it whatever, thus demonstrating the safety of such wheels.

Electric Miners' Lamp.—M. de Gerson has laid before the Paris Academy a new electric mining lamp which has been tested by the Ecole des Mines, and which is to be experimentally used in one of the most dangerous of the Anzin Mines. The weight of the lamp is 1600 grammes, and the light given is of about a normal candle power. The lamp gives light for a period of 12 hours before having to be recharged.

The amount of phosphorus consumed per annum is about 2,000 tons, and is chiefly used in match making. Hitherto chemicals were used in its manufacture, but by a recent improvement the raw material and coke are placed in a specially-prepared furnace, and electric heat is applied. The vapor arising is condensed, and marketable phosphorus is produced.

Successful Re-opening of the Asbestos Club Rooms at Black Lake, Que.—A Thoroughly Interesting and Enjoyable Gathering.

The Rooms of the Asbestos Club at Black Lake, Que., recently destroyed by fire, were re-opened with great *eclat* on Thursday evening, the 24th instant. The club room was crowded, among others present being Hon. George Irvine, Judge Dugas, Mr. James King, Mr. E. D. Ingall, Mr. E. Wertheim, L. A. Klein, Col. Lucke, John J. Penhale, John Johnson, Mr. Douglas, Glasgow, Scotland; Mr. Alfred Ward, Mr. T. Sheridan, H. J. Williams, A. H. Murphy, Peter Ward, A. M. Evans, G. M. Melville, S. J. Johnson, B. T. A. Bell, and many others prominently identified with the mining industries of the Eastern Townships.

A pleasing feature too was the presence of the following ladies: Mrs. Richard Penhale, Mrs. L. A. Klein, Mrs. Crabtree, Mrs. Proteau, Mrs. Matthew Penhale, Miss Penhale, Miss Maltby.

Mr. Matthew Penhale, vice-president of the club, occupied the chair, and in a few graceful words introduced Mr. E. D. Ingall, M.E., to the Geological Survey of Canada, to read his paper on the subject of:

The Functions of the State Investigator in Relationship to the Mining Industry.

When your worthy Secretary wrote to me the kind invitation to be present at the opening of your new Club Rooms and suggested that I should read a paper on the occasion, I must say the former proposition struck me more favorably than the latter, as reading papers is not much in my line. The temptation, however, to be with you on the occasion and exchange ideas with my brother professionals of the asbestos region was too strong, and I decided that my inherent aversion to that kind of dissipation must be overcome.

I have thought that the subject as outlined in the title to my paper might be appropriately considered on such an occasion as this, and I feel sure that if a review of our relative positions in regard to the whole work and necessities of the profession and industry should lead to any fuller measure of co-operation of all for the common good, the introduction of the subject to your notice will have been justified and my own effort fully repaid by your sympathy with our work.

When we think that the ultimate object of the mining industry, is to extract from the earth's crust various mineral substances as required by mankind, and to bring them to such a condition that they become available as raw material for the manufacturer, it is not at first very evident where the function of the Government investigator comes in, seeing that so far the State leaves all such questions of the supply of the necessities of its existence to private enterprise. The community at large, however, *is* interested in having the most made of the resources of its country and in having the supply of the material it requires produced as cheaply as possible—that is, with the minimum of expenditure of time, material and energy. This requires that those having the direction of the operations for winning these mineral substances should be armed with the fullest possible information and should come to their task with a thorough knowledge of the nature, modes of formation and habits of the deposits to be worked, and the bearing of the geological surroundings on the probable extent and nature of the same.

So far many of those engaged in the industry have, I know, regarded this theoretical knowledge as of secondary importance to the exercise of the mechanical and technical side of the profession with its more immediately evident connection with the object to be obtained, but I think we may say that with the progress of time a better understanding is being arrived at with regard to the very practical nature of true theoretic knowledge, and that when properly understood there's decidedly "money in it."

In fact one may say that to a great extent the mining art has been regarded from the point of view of "taking it out," but on the principle of "first catching your hare before cooking it,' it is evident that precedence must be given to the consideration of all that pertains to the finding of the required article whether by underground development or surface exploration, whether in hunting for the deposit or in its subsequent opening up.

In this connection then the need for geological knowledge is evident, else our search and subsequent operations will be directed by the very wasteful process of hap-hazard. If one could only state in dollars and cents the actual amount of waste due to this cause for any given time and area, I think the figures would astonish many, but one can only form an idea by so constantly seeing examples of the results.

It is a great mistake to suppose that theory is ever divorced from practice as everyone engaged in developing a mineral deposit will be found to have some sort of theory, some ideas as to its nature, whereby he guides his actions. It may not be the true theory based on the widest experience of humanity, but if not, it will be one which, springing from the narrow limits of an individual's experience, and often largely tainted with gratuitous imaginings, is therefore very apt to be mistaken. If looked for, instances of this will be found at every turn, with their resulting waste of money, material and energy. In one district I was in, I found a belief prevalent that "true fissures always run dead straight," and as a consequence in one instance a picket line, starting from the outcrop of a vein had been run through the bush out on to the clay lands of the valley and a lot of money spent sinking shafts through a thickness of cover, evidently very considerable, to find the vein which, being firmly believed to maintain an absolutely straight course, must be therefore surely attainable by this method. Needless to say no useful result was attained. As another instance might be mentioned the belief largely held some years ago about the Canadian phosphate deposits, viz., that they did not "go down," which lead in so many instances to the premature abandoning of effort on encountering the first "dead ground," and the consequent retardation of the development of the district.

The question then being admitted of the necessity of such general or theoretical information being at the disposal of those who are to apply it to the solving of the problems of an individual mine or district, whence shall it be obtained? The theory being but the summarising and generalized form of the knowledge gained by practice, a certain amount of this generalization has always been existent, and before the times of modern science, mining districts of centuries standing, such as those of Germany, England and elsewhere, had their theory and their code of generalizations taught from mouth to mouth and handed down by tradition. Such theory, however, was only local in application, and whilst often marvellously correct within these limits was still considerably diluted with error, due to the imaginatory contributions of ill trained minds, and always had the disadvantage that in its crude mode of statement it was inapplicable to new districts with different conditions.

Thus we see that in the more primitive ages, practice and theory existed side by side — the lion lying down with the lamb—but in these post-millenial times, this happy partnership has, to a certain extent, been dissolved, and the practical miner finding an ever-growing necessity to occupy himself with the commercial necessities of his position, has to, largely or altogether, cease to be an investigator, so that one might almost classify the fraternity under the two heads of "investigators" and "applicators."

Thus has arisen a necessity that the progress in further study of the nature of mineral deposits and all that pertains to the subject should be undertaken by hands other than those already so busy with other branches of mining, an inevitable result of the application to human affairs of the principle of the division of labor.

In mining, as in all other branches of human industry, every year sees a greater demand for skilful and economical handling, and any increase in the theoretical knowledge must contribute to this end, true practice being but the application to individual problems of true theoretical knowledge. If our knowledge, however, is to advance beyond the point at present reached, such result must come from extensive study, costing much both in time and money. The latest methods of research must be at command and freely used, and it cannot be expected that the mining engineer engaged in practical work can spare either much time or money for the task.

A great deal has been done by voluntary contribution as it were, by men of means and leisure devoting themselves to scientific research, but yet there remains an enormous field of operations. Luckily the undertaking of this has been recognized the world over as an important function of the State as evidenced by the existence of the Government Geological surveys which are found in every civilized country. On these corps of "State investigators" (as I have called them for want of a better term), devolve the duties of making the studies before alluded to, enabling them to supply to the miner the information which is demanded by him for the attainment of the best results of practice.

Such an organization has to deal with the very diverse requirements of a very mixed public, for not only must their work meet the wants of the local mining fraternity, but the reports must also supply the information called for by the scientific and non-scientific public, the legislator dealing with the resources of the country, the investor, both native and foreign, and many others, nearly every one being more or less benefitted by the results obtained.

Thus we find that a Geological Survey must undertake very various work, which may be considered under the following headings:

The Natural History Division, whose work, whilst otherwise widely useful, has a less direct and tangible interest to the mining fraternity, but whose utility to us is easily recognized when we remember the very important part played by fossil evidence in the working out of the geological structure of a district.

The Chemical Division, the necessity for whose existence is evident with its analyses of minerals and ores and the demonstration of their fitness for use, etc.

The Mineralogical Division, contributing to our knowledge of the nature and associations of our mineral species and the indications they yield—through the changes found to have occurred in them—of the nature of the forces at work in the formation of our mineral deposits.

The Field Staff, whose work might be further classified under the heads of Preliminary Explorations, Systematic Geological Mapping, and Mining Geology. In a new country like ours there are always large tracts of unknown territory, of whose resources it is necessary to know with a view to their development. Into these districts then will go the pioneer parties, working by methods which, whilst not so accurate as those possible in the more developed sections, are yet sufficiently so for preliminary work, and allow of the necessary rapidity of transit in order to cover a reasonably large tract of country in the season. Thus their methods will consist in the traversing of the w[illegible] track surveying the routes passed over, a[illegible] henomena encountered, so that the report of the work will comprise information on everything pertaining to the natural resources of the section visited.

The systematic geological mapping of the country is of course a process familiar to all. Being a work of considerable detail, it is evidently only possible in sections where facilities for travel and for getting at the rocks is considerable, and hence follows the settlement of the country. To be of lasting benefit it must be carefully done, and is hence slow of attainment, and in its nature must be carried out on a systematic plan. For this purpose the map of the country is usually divided into sheets; as soon as one is finished an adjacent one is begun. Each of these represents an immense amount of painstaking work, both in investigating the nature and relationship of the different formations or groups of rocks, and in mapping their distribution. It has been customary with many to regard this work as "purely scientific," and as of no use, as so much of it relates to areas yielding little or no economic minerals. One might as well assert, however, that because one did not live in the cellar, a foundation to a house was of no good, whereas in reality this work is the basis on which all the more immediately useful work must be built up. For instance a man would be ill fitted to investigate a mining district who understood nothing of geology, and yet how could it be taught at our universities, or anywhere else, if one were to refuse to collect that information which constitutes geological science. It may seem to some that an attempt is being made to prove a self evident fact, but it is unfortunately the case that there is a large section of the public who take the view combatted. One might dilate upon the multitudinous benefits of such work, but it would be unnecessary and tedious in a scientific audience such as this.

Having now dealt with the main body of the army—as one might say—and with its steady advance we come to another branch of the forces which constitute what one might call a flying column, to be sent out in any direction in which special necessity arises without disturbing the systematic advance of the main body.

I refer to the work of the mining geological division, with which it has been my pleasure to be connected since forming the staff.

As new discoveries of mineral are made in various parts of the country, constant need is arising for special investigations apart from the systematic progress of the Survey. The necessities of this kind of work require that it should be differently treated to the rest. Whilst a comparatively small area is undertaken, much more detailed work is required. The systematic mapping of the country deals with groups of rocks, but in the immediate vicinity of mines we must read closer, and deal further with individual rock units, and with all the minutæ of the structure, To attempt to work in such detail for the general geological maps of the country would be manifestly inimical to the interest of that work, and indefinitely postpone its completion. Of the work now under consideration, we have examples in the various reports of our own Survey on the mining districts of the Dominion, and also in the splendid monographs issued by our southern neighbours.

When we study these we see some of the relationships of the Government Investigator to the mining industries clearly illustrated. In them is to be found all the evidence as to the nature and habits of the deposits worked, analysed, summarized and supplemented by the personal investigations of the geologist, and put in such form that future effort can be directed by the light of past experience. The nature of the rocks existent in connection with the deposits has been demonstrated not by mere eye examinations, but further by the aid of chemical and microscopical investigations. A vast flood of new light has been thus thrown on the subject, not only illustrating the present composition of the rocks, but also upon the alterations they have undergone and the causes producing these changes and acting in the formation of the deposits of ore.

Of the great utility of such knowledge in practical work one might draw endless illustrations, did time allow and were it necessary before an audience such as this, so familiar with all that pertains to our art. I shall not, however, now occupy your time with this view of the matter, but pass on to the consideration of the question of how we can best collect and render generally useful more of such information. An excellent beginning has been made and much useful work has been done in the last fifty years or so since geological investigations have been brought to a systematic basis. When, however, we look into the state of our knowledge in this respect, it is evident that the work has been but begun and that an enormous field of research yet lies open to us, and a harvest of the most useful results awaits the reapers hand.

We have reviewed then the necessity for theoretical information of the nature of mineral deposits, their geological associations in the application of the art of mining to their development with the need of continuous extension of our knowledge of these matters. We have seen that it is a work of great complexity, that problems have to be faced calling for the application of the fullest methods of study for their solution, as generalization of value cannot be obtained by the examination of a single mine, and that it must, therefore, be undertaken by those who being in the employ of the State can make it their life work, but this will not be enough if we are to add to our knowledge at a satisfactory rate, and secure for ourselves and the future all the experience gained from mining operations the world over.

For this we require the fullest measure of systematic co-operation by all interested, and it is here that we may look for improvement in the closer and more understanding relationship of the State investigator with his practically engaged brother. Let us not then look askance at each other; our functions are different but all have their part in the economy of the whole science. The practical miner has great opportunity for accumulating material in his day by day observation of his deposit as it is developed under his eye. Every mine opened up is an experiment and an object lesson, yielding raw material which, when compiled, correlated and, as it were, manufactured into theory, shall yield principles and knowledge by which all future procedure shall be improved in an ever-increasing degree. On the miner engaged in the practice of his profession necessarily devolves much of the duty of collecting these data, but unfortunately this has never been clearly recognized, and untold amounts of most useful knowledge have already been lost and are being lost every day. When a mine has closed, all its records and plans, if even they existed, have been lost, and when all those conversant with its history have wandered away to other parts, an irrecoverable injury has been suffered by our fraternity in the loss of knowledge and experience, costing thousands of dollars in its acquirement.

In regard to these investigations and studies, the functions of the State officer must be evidently confined to that part of the whole work which, being nobody's business, would else remain undone. Had he a thousand eyes he might collect all the data for himself, but if he could trust more to his practical brethern for much of his material and confine himself to his proper functions of elaborating this and presenting it in a useful form, his field work could be concentrated on such studies as were necessary to complete the record and of such a general nature as to be outside the scope of the efforts of the practical miner.

He also performs another useful function in that he provides an outside and disinterested person to whom information so often of a confidential nature, may be entrusted to be stored up until the lapse of time having removed the necessity for secrecy, it can be used for the good of all. The confidential nature of this relationship has become recognized of late years so that we find it specifically defined in our own Geological Survey Act passed last session, and in that of the United States and others that their officers shall in no way become pecuniarily interested in mines or mineral lands.

How then shall we begin to carry into effect this much to be desired understanding and fuller measure of co-operation between the different members of the mining fraternity, and between them and their brethren in the employ of the state.

Firstly, let each one make it his business to bring about, amongst others, a better and wider understanding of this relationship, and of the desirable results arising from its practical recognition. Let them explain that the state investigator, the Government geologist, is not an outsider with whom they have nothing to do, an amiable crank, who at best should be left alone as harmless, or a Government agent sent in to spy out the land on the behalf of some mysterious outside interests, but that primarily he is a member of the mining fraternity, entrusted with special duties, acting in its interests, and a necessary part of the economy of the whole, and that all branches of his work are useful either directly or indirectly, either immediately or in the future.

Secondly, let all pay more attention to the study and recording of the natural phenomena, which come under notice in the development of the mineral deposits, and the prosecution of the work under their direction.

Thirdly, let such record be systematically and fully kept and put in shape for future reference, and here I may enter a plea for the wider prevalence of the practice of keeping plans of mines—posted up to date—with full notes of the rocks encountered, phenomena presented by the deposit, and all such information recorded on them.

Fourthly, let us strive after a more complete organization of our efforts, a more understanding system of co-operation for the attainment of the object in view, viz., the extension of mining science and the widening of the basis of knowledge upon which our art is founded. Let each mining district have its club or associatton, such as your Asbestos Club here, and let them be assisted by the state, and recognized as necessary parts in the whole economy of mining, they in their turn acting as agencies for the central state investigation bureau. Let them see that no item of useful information is lost, but that whether it be illustrative collections of specimens or records of mining developments, that all shall be carefully collected, and either kept on the spot, or perhaps better, transmitted to the great central storehouse of such records for safe keeping.

Of course, as to the other functions of such organizations as yours, it would be out of place to dilate in this connection, although it is a subject whose consideration would lead to much useful discussion, nor shall I attempt to further follow the subject in hand and tire you, but shall content myself with a few final words to beg a continuance of your assistance in the work it specially rests with myself to carry out as being in charge of the Division of Mining Statistics and Mines of the Geological Survey.

It has been recognized both here and elsewhere that a legitimate and important branch of the work of such a survey consists in presenting to the public an annual review of the economic condition of the mining industry, and it is one which more than any other calls for the hearty and prompt co-operation of the mining community for its successful fulfillment. The information solicited is asked for in no inquisitorial or impertinently curious spirit and is always accepted as confidential, whilst in the recording of it in the office and in its publication, precautions are taken to guard fully against any injury to private interests. I cannot do better than close my appeal on this point in the words of Mr. F. S. Emmons of the United States Geological Survey, in a paper read before the American Institute of Mining Engineers, where, speaking of the collection of such information, he says: "The influence of the individual members of the Institute can be of the greatest use to us if they will take the trouble to explain to these mining men with whom they come in contact the practical value of the work and persuade them to answer our questions promptly and in a friendly spirit. It is often more labour to get information from one or two reluctant individuals than from a whole district or State;" and I may add that the absence of one or two items often delays the issue of the whole report.

I have thus far attempted to pass in review the functions of the State investigator in relationship to the mining industry, the mode of application of the principles found to underlie this connection and the benefits that may be expected to accrue therefrom, but in judging of the results—so far accomplished—I would beg your attention to a few considerations:—

Firstly, we know only too well ourselves that our attainments fall far short of what they should be, but the work is young yet and the difficulties both outside and inherent in the work itself both hard and tedious to be overcome.

Secondly, we must judge of all such work from a wide standpoint not merely from that of our own individual interests or those of our own district and remember that the reports are written in view of a distribution amongst a very wide public with very diverse wants and that what may be no news to ourselves may illustrate our district or industry to others.

In fact I can only quote to you in this relation the notice stuck up at the door of the church in Leadville when that prosperous city was yet young, on which might be read the plaintive appeal, "Please do not shoot at the organist, he is doing his best."

I would not of course deprecate proper criticism for it is a useful spur to continued improvement, but to be useful it must be both friendly and just, without which it does but little good and militates against that consolidation of effort so much to be desired.

In conclusion then, as we would wish the history of mining to be a record of continued and rapid progress let us all, the practical miner, the technical press, the scientific investigator, in fact the whole mining fraternity, keeping that object steadily in view, work harmoniously together for its attainment, for the realization of the principle of the *profit each in the benefit of all*, and let us take for our watchwords Fraternal Sympathy and Systematic Co-operation.

Mr. Ed. Wertheim, Managing Director of the American Asbestos Co., next read the following paper on the subject of:

The Uses of Asbestos.

It is not long ago since our mutual friend, Mr. Evans, in his capacity as secretary of the Asbestos Club, surprised me by the request to read a paper before this club and its visitors on the occasion of the opening of the new club room. I call it a surprise, because I did not expect such a privilege. The fact of the matter is that I do not consider myself sufficiently trained, and more than that, I do not consider myself master enough to speak before an audience, especially an English audience, as I know hardly enough of that language to get through an every day conversation without making some funny blunders. Well, gentlemen, if you find that I am correct in saying that I am not fit to read before such a prominent party as has gathered around us to-night, don't blame me, but blame those who made me do it, especially our worshipful secretary.

Before I come to the real objects about which I intend to speak, I might say a few words not directly connected with them, but which I consider opportune enough to be expressed in this place and at this time. I refer to the opening of this club room.

Gentlemen, the Asbestos Club has had a hard time, and a constant struggle ever since it first breathed the air of the asbestos region. All kinds of obstructions have had to be got over, as those know who took an active part in the management of the club, but they managed to keep it going until on a certain gloomy Sunday in June a disastrous fire swept away the mortal remains of the Asbestos Club. Strange to say that an asbestos club should have suffered a death of fire after hardly a year's life. Asbestos, the great fire-resister, should have lent its name to a club that would die of combustion. No; it would have been considered no recommendation to the fire-resisting powers of asbestos if the Asbestos Club would have been satisfied to perish under the ashes of a wooden building. No, gentlemen; like the Phœnix who rises from the fire with new life, spirit and power, so the Asbestos Club has arisen with new strength and glory, brighter than ever before, and proud of having the opportunity to prove that a powerful element such as fire is by no means powerful enough to injure the life of anything made of asbestos.

Here we are to-day assembled to celebrate the opening of this new home of the Asbestos Club, to celebrate its resurrection from a death of fire. Gentlemen, it would be hard to find a more appropriate opportunity for a celebration in that part of the world where the production of asbestos is the sole object and the only work which its inhabitants pursue. Let this opportunity not pass without remembering all the good purposes for which this Club has been established, and let us recognize the efforts and the lot of work which the officers of the Club have taken upon themselves to enable us to hold our meeting in such a comfortable and suitable place as we have at our disposal to-night. I think the best way in which we can express our gratitude is to make up our minds to encourage them and to encourage the further development of the Club by regular attendance at the meetings and by frequent visits to this hall. If we form such decisions, and do our best to carry them out, I am sure we can show the world that the Asbestos Club is not only *incombustible* but *everlasting*.

And now, Mr. Chairman and gentlemen, let me come to my subject, "The Uses of Asbestos."

There is no necessity for me to explain to you what asbestos is—you all have had some dealings with this remarkable mineral—and I can confine myself to describe some of the many uses to which this mineral has been and is now being put.

Asbestos has been used, one might say, ever since mankind had the ability of making a thread out of a fibre. Even without giving full credit to the numerous reports of the old Egyptians having known and used asbestos 3,000 or 4,000 years ago to manufacture an incombustible canvas to envelop the bodies of the dead to be cremated on the funeral pile, and thus to retain separate the ashes destined to be deposited in the family urn, I say, even allowing these stories to be somewhat mysterious and liable to be argued upon, there seems to be no doubt that asbestos was known long before the records of history were retained in such a way as to leave us no doubt about their credibility.

Not only was the mineral known, but also its wonderful quality of being able to resist fire.

The word itself, asbestos, or as our friends at Ottawa persistently call it, "asbestus," is a plain proof that the people who gave this name to the mineral—or, as they may then have believed it to be, a plant—were aware of its fire-resisting power, for "asbestos," a word derived from the Greek, means nothing else but imperishable, incombustible, unchanged by fire.

The word is found mentioned in many old books and scriptures as also is the word "amianthus," which means pure, incorruptible.

The question is, however, left open, whether by the names of "asbestos" and "amianthus," our forefathers meant the same mineral which we now know in the trade as such. Some will not admit it, and they think that the name of the mineral which is produced in this district is neither amianthus nor asbestos, but "chrysotile." However, let others fight that out, it is sufficient for us to know that the mineral which we produce is known all over the world as "asbestos," and goods manufactured therefrom as "asbestos goods."

The manufacturing of asbestos goods forms at the present date a very important industry both in America and Europe, and it may be said that it owes its importance principally to the discovery of the asbestos in Canada. Until then, say 1878, the uses of asbestos were very limited indeed, owing to the difficulty of spinning the only kind then known to be of commercial value, namely the Italian. I will not enter into the question of which is the superior kind; it will be sufficient to say that until 1878 the yearly consumption of asbestos did not amount to more than 500 tons, while since the discovery of Canadian asbestos the uses increased so much that in 1890, more than 8,000 tons were probably used.

I have mentioned that the spinning of asbestos caused difficulties owing to various circumstances. First of all the fibre has not sufficient strength to withstand all the operations to which other fibres, be they of vegetable origin, such as cotton, flax, etc., or of animal origin, such as wool, silk, etc., have to be submitted, and another difficulty is found in getting various asbestos fibres to adhere to each other. While fibres such as I have mentioned, wool, flax, etc., have a rough surface, the surface of a single asbestos fibre seems to be perfectly smooth, something like spun glass, so that in trying to twist a number of single fibres together they slip past each other and thereby add to the difficulties mentioned. Science, however, as well as continuous study of the nature of asbestos fibre, has, to a certain extent overcome the difficulties, and manufacturers have succeeded in turning out a single asbestos thread which, although not weighing more than an ounce to 100 yards, has a pretty fair strength.

You will see by some samples which I have before me and which I shall presently pass around for inspection, to what a degree the spinning of asbestos has been accomplished.

The short notice I had of my lecture to-night did not permit me to procure representative samples of the best that has been done.

The manufacturing of asbestos in other ways than spinning it, has not the same amount of difficulty, as, for instance, the manufacturing of paper, cardboard, etc.

It is difficult to say in which manner asbestos finds its largest consumption. The market seems to vary in various countries. While in the United States and Canada large quantities of short fibre are used to manufacture pipe-coverings of all descriptions, the European market calls principally for long fibre to be used for spinning, braiding and weaving.

As a pipe and boiler covering Asbestos is claimed to be superior to most other non-conducting materials, because of its heat-resistance and because it adheres, being fibrous, better to smooth surfaces than powdery substances. The variety of pipe and boiler coverings in the market is very great, and the number of companies which make the manufacturing of it a specialty shows what an important position this article has gained in the United States.

Asbestos is used in various ways for the purpose of preventing the radiation of heat from pipes, boilers, tanks, etc. One way is to mix loose asbestos fibre, after freeing it fairly well from stone admixtures, with other materials which either serve to increase the non-conducting qualities of asbestos or to make the composition adhere better to the surface of the pipes, not to speak of the admixtures which sometimes have for their only object the cheapening of the article and the substitution of a cheaper material for the costly asbestos fibre. To apply a composition manufactured in that way to a pipe, consists of mixing it with water and putting it on in thin layers with a trowel, allowing one to get dry before the next layer is put on. To finish off, canvas or oil-cloth is used, which prevents the covering from falling off, should it in the course of time become cracked.

Another mode of using asbestos for covering pipes is effected by forming it into sectional pieces which are placed on the pipes and connected by means of wire or canvas. This mode of applying asbestos has the principal advantage that it can very easily be put on and taken off the pipes, and that the same covering may be used for a great length of time. Special sectional pieces of such covering are made to fit elbows, tee's, crosses and other fittings. As sectional covering asbestos is often used in connection with hair-felt, fossil meal, magnesia, cork, etc. It is claimed that by a good asbestos covering as much as 25%, 33⅓% and even 50% of the fuel can be saved, and when once a selling agent praising his goods, ventured to promise even more than that, his customer wanted to know how much asbestos covering he would have to use in order to dispense with the fuel altogether.

A composition of asbestos is also manufactured to be used as a cement for the backing of fire grates and furnaces, or as a fire-proof putty to be used between rough or uneven joints; as a paint, fibrized or powdered asbestos, mixed with other ingredients, serves as an effective preventative of fire by applying it to wooden structures. By a special preparation such paint can also be made waterproof and then can be used outside as well as inside. Fibrized asbestos also serves as a filtering medium in chemical works, and for packing steam cocks and chemical pumps. In warfare asbestos fibre has been adopted for numerous purposes, for closing the breeches of big guns in connection with torpedoes, and even as a lint in hospitals and on battle fields. Some very interesting experiments were made some time ago by the British Admiralty with respect to using asbestos fibre as a coating for men of war. The idea was that if asbestos fibre is pressed firmly together, it would prevent the inflow of water after the penetration of a ship's side below the water line. I cannot however, say, whether the experiments led to a final application of asbestos for such purpose.

Asbestos fibre is to some extent used, especially in England, in connection with gas fires; the gas is made to rise through asbestos and then lit. The asbestos fibre glows while the gas is burning, and thus not only serves to spread the heat, but also gives a pleasant appearance to the open fire-place. I may also add that asbestos fibre is used in water filters, and is claimed to be very effective as such.

Manufactured into paper and millboard (I pass samples around of same), asbestos finds a variety of uses. The millboard serves as a joint packing for steam pipes, cylinder covers, steam chest covers, etc., and is greatly appreciated for its durability, economy and cleanliness. It will adapt itself to uneven surfaces, and forms a perfectly tight joint, which with very little care can be removed and replaced without injury. For special purposes, especially where there is any lodgment of water in the steam pipes, asbestos mileboard can, by special treatment, be made perfectly waterproof, and I pass a sample around of such waterproof board, which is known in the trade as asbestonite. Asbestos millboard is also used for other purposes, such as the construction of fire proof deed boxes, etc.

Asbestos paper is very largely used, the manufacturing of it in the United States alone being estimated at 1,500 tons per year. Its principal use is for building purposes. Placed between two layers of boards, in ceilings as well as walls and partitions, it necessarily tends to reduce greatly the danger of fire in as far as it checks a fire which starts in any part of a building thus protected. When the flame gets to the asbestos paper, there can be no doubt that it has to stop there for a time until the paper gets so much heated that wood or other combustible materials on the other side of it can ignite, and such a delay very often may save a building. In fact, insurance companies have agreed to allow specially low premiums to houses which are thus protected. Asbestos paper placed underneath the roof also acts as a non-conductor of heat and cold, and contributes to hold a building warm in the winter and cool in the summer. Asbestos paper is also printed and colored same as ordinary paper, and then serves as a wall paper (sample), filling both purposes of decorating and protecting the walls. For electrical purposes asbestos paper is also extensively used in Europe, and likewise as a filter in chemical works. Asbestos paper can also be specially prepared to be used as a non-combustible writing paper, and as such is invaluable for deeds, contracts, and other valuable documents. In theatres it is largely in use in connection with side scenes, possessing the advantage, besides being fire-proof, of showing the colors much brighter than ordinary paper, owing to the bright white color of the paper itself.

Asbestos in its spun state is very largely used as a steam packing, be it in the shape of yarn, or as it is often called, wick, for packing small glands, valves and cocks, or in the shape of piston packing, for piston rods, valve-stems, throttle-valves, etc. In the application for these purposes the heat-resisting quality of asbestos has been found to make it specially suitable for superheated steam, as is used in the large triple and quadruple expansion engines used on the fast ocean steamers. Asbestos-packing has stood the test where all other packings, such as soapstone, hemp, flax, cotton and even metallic packings have failed. It is durable, reliable, and economical. Durable, in that it is not affected by the heat or moisture, and less than other packings by friction and pressure. Reliable, because as it does not require to be frequently renewed, the regularity of motion in the piston is preserved and as a consequence all the machinery connected with it runs more smoothly. Economical, for the reason that being to some extent a self-lubricant, it saves in oil and friction, and from its elasticity, caused by its fibrous nature, keeps the joint perfectly tight a longer time than other packings. The most common asbestos packing is made by either twisting or braiding asbestos wick or yarn together into a rope, but a great many other kinds of asbestos packings are in the market. Sometimes wire is used to increase the durability and strength of the packing, sometimes an India rubber core is inserted to increase the elasticity. Asbestos packing is manufactured with a filling of powdered soapstone or graphite, in order to increase the lubricating power, and so on. A very superior kind of asbestos packing is made by first producing an asbestos cloth and then rolling this up into any desired thickness, placing rubber solution on between the layers. In a similar way, by uniting layers of asbestos cloth, a flat packing, generally called asbestos and rubber sheeting, is made, which can be cut into rings of any shape and form and thus used as a superior flat-joint packing, instead of mill-boards. Tape made in a similar way can be bent into the form of a ring and used for the same purpose as the sheeting, having the advantage of leaving no waste to the consumer. Such asbestos and rubber combined packings are very much in use, owing to the advantage they have over the ordinary asbestos packing of being more resistant to moisture, and also of withstanding a still higher pressure, owing to the peculiar way in which they are made. A so-called asbestos block packing is made by uniting a number of layers of asbestos cloth by means of India rubber, then placing a flat rubber back cross-ways at the edge of the layers and covering three sides by a cotton cloth, leaving one side to face the piston rod. The rubber back gives it a great amount of elasticity, while the friction acts against the edges of a number of asbestos cloth layers. This packing has an enormous power to withstand steam pressure. I pass around a variety of steam packings made wholly or partially of asbestos. The next important use of spun asbestos is in the shape of asbestos cloth. This being a fire-proof and flexible cloth has found use for a great many purposes. As theatre drop-curtains it is in use in a great many theatres both in Europe and America. Asbestos curtains have the advantage of being much easier handled than iron or steel curtains in case of necessity, which is a matter of no small importance when a fire breaks out during the performance. Garments made of this asbestos cloth are used both as a protection against fire and also as a protection against injuries from acids. Gloves, gaiters, aprons, caps, masks, blankets, bags, etc., are made of asbestos cloth and constantly used. Fire brigades, as well as firemen and furnace men in iron and steel works, use them as a protection against heat and fire.

There are a number of other uses to which asbestos has been and is now being put, and they are too numerous to be detailed in a short space of time such as is at my disposal to-night. I might mention that belting is manufactured of asbestos, to take the place of leather, cotton and rubber belts in places exposed to heat or acids. Soldering blocks are made of asbestos for the use of jewellers, dentists and all those who use the blow-pipe; cords and ropes are being made by twisting asbestos threads together, and serve as fire escapes and rope ladders. Asbestos wicks are also used in lighthouses, where the saving of frequent trimming is a great advantage; for covering electric wires the use of asbestos is fast increasing; as a roofing, asbestos, in connection with wire netting, and rendered water-proof, also finds considerable use; fire bricks are made of asbestos; asbestos has been introduced in the shape of cigarette paper, dispensing with the inconvenient and unhealthy smell of burning paper; in short, the uses of the mineral are of such a variety as hardly those of any other material. A flexible fibre, which is practically fire-proof, acid-proof, self-lubricant, a non-conductor of heat and electricity, is bound to be found useful as industry progresses, and the chances are that new uses, now unthought of, will be discovered, and will increase the consumption in a degree which will surpass the most sanguine expectations. Unless new discoveries are made of suitable qualities of the crude material in other parts of the world, which then might share in the supply of the world's demand, the district in which we find ourselves at the present moment is bound to flourish for a long time to come by the production of that wonderful and remarkable mineral, asbestos.

With this hope, Mr. Chairman and gentlemen, let me finish this little paper, asking you to excuse me if I have too much imposed on your good nature and patience. I thank you all for the attention you have given me to-night.

A vote of thanks having been conveyed to these gentlemen for their papers, and to the ladies for gracing the meeting with their presence, the meeting adjourned downstairs to the supper room.

The Supper.

Here one found a spacious room decked out with evergreens and flags and many emblematical designs of the miner's calling tastefully adorning the walls. Mr. James King presided, and Mr. Matthew Penhale occupied the vice-chair. After ample justice had been done to an excellent bill of fare, the following toast list was gone through: "The Queen;" "The President of the United States," replied to by Col. Lucke, Sherbrooke; "The Asbestos Industry and its Club," proposed by Mr. Ingall and replied to by Mr. James King; "Our Guests," by Mr. E. Wertheim, and replied to by W. M. Douglass and Mr. Martin Longee; "The Mining Industries of Canada," by Judge Dugas, replied to by Mr. B. T. A. Bell, of the CANADIAN MINING REVIEW; "The Geological and Natural History Survey of Canada," by Mr. A. M. Evans, replied to by Mr. E. D. Ingall, M.E.; "The Ladies," by Mr. John Penhale, reply from Mr. J. C. Noel, B.C.L. At midnight the party adjourned to the Club Room, where songs, recitations and dancing brought to a close a thoroughly enjoyable gathering.

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The Phosphate Market.

The following translation from *L'Engrais* of the phosphate situation in Europe will be of interest. We therefore quote in full:

The ruling prices are about the same, with a weak market, the French and Belgian products being entirely neglected.

We perceive, however, that the limits favorable to the purchaser are attained, and they now open negotiations for 1892 and 1893 deliveries. Buyers, nevertheless, hold pessimistic opinions concerning this article, and even some sellers are not too optimistic. The true situation is to be found in an equitable medium of a reasonable quotation, neither too low nor too high, and it beholds us to ring the true key under the present circumstances.

To believe in the return to old prices as do some producers, is to be dreaming while awake. The low prices are not the result of a cabal of ephemeral influences, but the consequence of the European production, and especially of the discovery of the Florida deposits.

We need not scare ourselves too much over Florida phosphates, neither should we avoid looking the danger in the face by putting our head under our wing as the ostrich, to avoid seeing what is going on at our neighbors!

Looking at the Somme deposits, and more particularly the richer qualities, we recognize that our own efforts are completely thrown in the shade by those of Florida, and it is by this latter market that we must be governed, or lose our export demands by forcing an exaggerated output from the Florida fields.

It is our duty to expose this fact, and not to conceal the truth.

Now, Florida Phosphate of $\frac{75}{80}$ % is offered at 11*d* and 1/2 per unit in English or German ports, which is about 1 franc 20 centimes per unit for 1015 kilograms accepted in bulk on delivery, and although not in a ground state, it is of a nature easy to be ground. Admitting 6 to 7 centimes per unit for grinding, we obtain 1 franc 26 centimes to 1 franc 27 centimes for 75/80 % delivered; it is this price that must guide us; then deducting freight and the small profit of the exporter, we obtain the value of our phosphate on board in our seaports. We are essentially dependent upon our exportation, our domestic consumption being far from absorbing our own production. By the above figures it is seen that we must not dream of fancy prices, but resolve to sell at reasonable figures.

Can we possibly expect a lower market in the richer qualities? We do not think that this eventuality is to be feared; the consumption of fertilizers is on the increase, and the richer qualities, notwithstanding long transportation, will always be in demand at all European markets; moreover, the comparatively lower prices of richer qualities will tell against the inferior grades. Buyers are wrong in reckoning upon a continuation of a falling market; the time is favorable to negotiate business on long terms at reasonable prices; one need not fear buying, there is nothing to risk.

One cannot but expect a change in the prices for the lower grades of Somme phosphate; they are now so low that it is evident they will recover themselves shortly. There are a quantity of small supplies furnished by individual proprietors in the Somme which cannot longer satisfy the superphosphate manufacturers, who are outfitted to buy unground phosphate. The low grades already extracted and put into stock, keep down the prices, because the holders wish to realise regardless of working cost, but when such are absorbed, who will recommence extracting and manufacturing at a dead loss.

We are of the opinion therefore that the low grades of some phosphate are at their lowest quotations, and that they will recover within a few months' time; we believe also that the higher qualities will maintain reasonable prices, if the producers do not force the sales, but we are persuaded that we must not figure to ourselves high prices which no combine can bring about.

Combines are necessary to sustain the article, and to limit the production to the demands of consumption but not for bringing about in an artificial manner high prices which are out of season.

It is upon this common sense basis that the syndicates of the Somme and of Liege should be founded.

The basin of Liege will always find a market for her excellent phosphate, but on the condition that she moderates the production; this is a question of life or death for this region.

Present quotations are not firmly established; certain deals at low figures in order to secure a sale are cited, but on the whole the quotations have changed but little.

In the Somme the 70/75 % is sold at 1 fr. .05 to 1 fr. .08 on cars at Doullens or elsewhere; and certain forward sales are mentioned at slightly lower prices for phosphate on board in our ports, or C. A. F. in English ports.

The 65/70 % without guarantee for iron alumina is a little neglected at 0 fr. .88. The same grade "washed" is more in request.

The 60/65 % not washed, is so to say unsaleable. Ridiculous prices are offered for it, but the producers will not sell at such extraordinary limits and prefer waiting. 66 centimes per unit are nominally quoted in the Somme.

The other qualities are altogether abandoned, otherwise they are little produced.

At Mons, phosphatic chalk of 40/45% remains about 43 centimes the unit.

At Liege, we await the formation of the syndicate. Some impatient sellers have done business, at any prices, it is said at 78 centimes for 55/60% with 3½% iron and alumina, and at 68 centimes for 50/55%. The inferior qualities are, figuratively, given away. It is high time that some combination should put a little order and discipline in these transactions which promised so well at the beginning of the Liége industry.

At the moment of going to press, we have received a letter from an English correspondent who appears to count on an improvement in prices; we should like to see this rise for the producers' sake, and would only wish for them that present prices remain firm; that would be already a good result. We shall publish in a following number some interesting statistics on phosphates.

Here are some quotations from this correspondence:—

"It is to be seen by the statistics that the United Kingdom has still to receive large quantities of phosphate, roughly, about 180,000 tons, during the second half year in order to attain an equal quantity to the importations of 1889, and some 220,000 tons to reach the total of last year. We believe, however, that the importations of 1890 were in excess of the consumption; but seeing that the English buyers, or at least the greater part of them, have not yet made provision for all their requirements of the approaching season, the returns show that they will still need large quantities, and that they cannot avoid soon coming to buy upon the market."

It is the same case in Germany.

We shall, therefore, shortly see a greater activity in this business, and if the sellers remain firm to their prices instead of lowering them, it is highly probable that there will be a stiffer market.

English Market.—The market is very quiet with prices tending to favor the buyers. Florida phosphate 78/80%; is quoted at 11½d, but one could buy perhaps a little below this price.

The 60% is not in request, and is not worth more than 10d. Bull River rock, kiln dried, is quoted at 10d, but is certainly obtainable at a lower figure.

The richer qualities of Somme phosphate are rarely offered, and maintain comparatively good prices. These quotations are: 11½d. for 80/75%, 9½d. for 60/65%, 8¼d. for 55/60% C. A. F. English ports.

Belgian phosphate 40%, is at 7d. per unit.

Canadian 70% is not worth more than 9½d., and the 60% is offered at 8d. without finding buyers.

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Phosphate Shipments from Montreal.

The following are the official returns of the quantities of Canadian phosphates shipped to Europe from the port of Montreal from August 12 to date:

DATE	NAME OF VESSEL.	DESTINATION.	SHIPPERS.	TONS.
Aug 12	SS. Monarch.	London.	Lomer Rohr & Co.	200
18	" Main.	Hamburg.	Squaw Hill Phos. Co	150
26	" Congo.	Glasgow.	Lomer Rohr & Co.	248
29	" Canopus.	Liverpool.	Wilson & Green.	555
Sept. 7	" Norse King.	London.	Squaw Hill Phos. Co	107
7	" "	"	Lomer Rohr & Co.	150
9	" Colina.	Glasgow.	"	45
9	" "	"	Millar & Co.	60
14	Ship John M. Blakie	Liverpool.	Wilson & Green.	268
14	" "	"	Lomer Rohr & Co.	175
14	" "	"	Millar & Co.	100
				2057

SHIPPERS' RECAPITULATION.

	Tons.
Wilson & Green	823
Lomer Rohr & Co.	817
Squaw Hill Phosphate Co	257
Millar & Co	160
Total shipments to date	2057

RECAPITULATION OF EXPORTS.

	Tons.
Liverpool	1098
London	457
Glasgow	352
Hamburg	150
Total tons exported	2057

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Herr T. Lange, in his new process for obtaining, by electrical decomposition, metallic zinc from solution of sulphite of zinc, uses zinc sulphite instead of zinc sulphate as electrolyte, as the difficulty of keeping the bath neutral is thereby obviated, and the metal obtained of better quality. Less power is required for the decomposition of zinc sulphite than for that of zinc sulphate, to the extent, it is stated, of 30 per cent.

CORRESPONDENCE.

Mining in the Kootenai District, British Columbia.

The district of Illecillewaet, the centre of the mineral belt of British Columbia, situated in the Selkirk Ranges, and with the Canadian Pacific Railway running right through the centre of it, is, after a period of quiesence, again showing signs of a strong vitality, and bids fair to make a stir in the mining world in the near future. This is not a matter of surprise to any who know anything about the capabilities of this surprisingly wealthy mineral district. The fact of its not being prominently to the front, is not because there are no valuable mineral lands here; but simply because the population has been so limited in number, and also that the resident population have not had sufficient means to provide the crushing and concentrating machinery requisite to reduce the ores to a marketable condition. The want of good trails to the various mines has been a drawback, but that is being overcome. There is a great opening here for the judicious investment of capital, to work and develop the mines of this district; and in no place or part of British Columbia would a higher return be given for the outlay. The galena here is of an extremely high grade, the average being from 100 ounces silver and 72% of lead and upwards. The ledges are large and well defined, and most of them true fissure veins, extending for miles and of a permanent character. The walls well defined, of gray schistic slates and black graphitic slate. There are a few claims where some extent of work has been done, and the ore has been packed down on horses and mules, and shipped either to San Francisco or Denver, U.S., where the returns have been over 100 ounces to the ton of silver. The Selkirk Mining and Smelting Company has been working for more than two years on their claim, the Lanark, on which they have expended some $30,000 in development work, by tunnelling, drifting, etc. They have a face of mineral twenty-six feet in width, and will soon commence to reap the handsome reward for their energy and perseverance. They intend to construct an ærial or cable tramway from the mine to the Canadian Pacific Railway track, and will be able to deliver their ore on the track at a cost of about 40 cents per ton. Formerly the price of packing down the mountain was $15 per ton. That will be the rule here for all the principal claims—ærial tramways—to get the ore down from the mountain. There are inexhaustible supplies of timber for mining purposes, and an unlimited supply of water for driving machinery everywhere about. No heavy sinking of shafts, hoisting and pumping gear required, as the chief part of the work can be done by tunnelling, and consequently the mine will drain itself. The capitalists of Canada seem to be unaware or indifferent to the mineral wealth of British Columbia, and to English capitalists it is nearly unknown; not so the American capitalists, who are snapping up everything that they can lay their hands on, and whose money even now controls most of the big mines now working in this province. They know a good thing when they see it, are always on the lookout for good mining property, and are not afraid to invest their money in development work. England spends millions every year in wild-cat ventures, of which not one cent is returned to the shareholders, and here are valuable mines laying idle for the want of some of that same capital that is so recklessly squandered on worthless ventures. If anyone visits the mines here they are simply astonished at the enormous wealth lying idle awaiting development, and a visit to the mines leaves an unfading impression on the visitor. There has been a new find in this district at Fish Creek, where an extensive mineral lode has been discovered, running nearly parallel with the Creek. It has been traced for nearly five miles, and there are now eighteen claims located on it. There is a surprising show of rich galena on the outcrop, blocks of galena from 100 lbs. to 250 lbs. in weight, showing freely. Assays of galena from this lead have shown 130 ounces silver, 70% lead. There is great excitement about it, and experienced miners all declare that it is the greatest show in the Province yet discovered. Fish Creek is about 17 miles from Illecillewaet, via Hat Creek; Canadian Pacific Railway runs past mouth of Hat Creek, which is five miles from Illecillewaet statiion, Canadian Pacific Railway. There is a great future before Fish Creek, but the natural outlet is down the Creek to arm of North Arrow Lake, thence to Revelstoke, but there is no trail that way yet. A trail is at present being made from Hat Creek to the lead, and a bridge is being built across Fish Creek, which is a turbulent, rapid and wide stream, running like a mill race, fed from the enormous glaciers at the head of the Creek. The smelter at Revelstoke is finished and now running low grade ores from Field in the Rockies. The smelter seems to work well, and the ore runs freely, but the work is not finished at Revelstoke, for though the ores are smelted, they are not separated, and the bricks run are composed of silver and lead, and they will have to be sent to England or Wales for treatment to separate the ores. But there is not the least doubt that very shortly all the work necessary to be done to make the district an assured success will shortly be done. Enquiries are being made from all parts and there is some strong indications that some of the best properties will soon change hands.

The town of Golden has given forth to the mining world in particular, and the rest of it in general, the first issue of a very creditably got up four page paper, to issue weekly. The matter is interesting and readable, paper good in quality, type clear and distinct. We wish the venture every success.

Mr. Kelly, M.P.P., lately visited us and stayed for some days. He is member for West Kootenay, and a thorough practical miner, and he is thoroughly well posted on the wants, capabilities, and requirements of the East and West Kootenay districts. He is of opinion, after a long, patient, and impartial research, into the various camps and mining ventures of the East and West Kootenay districts, that the prospects of the Illecillewaet district, for permanency, extent, high grades of galena and general capabilities for producing great wealth at moderate expense is, with one exception, that of Toad Mountain, the best in British Columbia.

We have had a visit from Mr. Ami, of the Geological Survey of Ottawa. He went to Fish Creek, ascended Granite Creek, and there found the contact of the granite with the gneissic rocks, trap rocks and basaltic, proving that a great eruptive upheaval has taken place here. It was believed to be so, but no geologist had succeeded in verifying this matter before. A great deal of harm was done this district by a report spread that the upheavals were not eruptive, and that there was consequently no permanency in any deposits of mineral; many left their claims and the district in consequence. But now this important matter will be set at rest and due confidence will be restored. Mr. Ami deserves great credit for the energy and indomnitable perseverence he has shown in overcoming the most serious obstacles, in determining this matter, and he risked both life and limb in his efforts over a country without trail or path, in which he had literally to fight his way through the thick scrub. There was also the pleasant possibility of meeting a grizzly or cinnamon bear at any moment. Unarmed, except with geological hammer, and tired from exertion, fortunately, he had not that experience, though they are numerous and their tracks are quite recent. Mr. W. Scott, of Illecillewaet, was his guide; an energetic prospector and well qualified to assist him.

The weather has been beautiful for some time, only varied with a few thunderstorms.

In conclusion, I can only reiterate what I have said in a previous part of this article, that there is no district in British Columbia that will better repay any judicious outlay of capital, and the extent, richness and permanent character of the lodes of mineral ore offer one of the safest and best investments now before the investing public. It is fully time that Canadians awoke to the fact that the wealth of one of the richest provinces of the noble Dominion of Canada, is going to enrich foreign countries.

EDMUND A. WATSON.

ILLECILLEWAET, B.C., Sept. 15th, 1891.

LEGAL.

Stewart v. Wright.

This case was heard in the Assize Court, Ottawa, on the 17th inst., before Mr. Justice Street and a jury. Mr. G. S. Kidd appeared for plaintiff, and Mr. F. H. Chrysler represented the defence. The suit was of particular interest to mining men, inasmuch as it hinged upon the point as to whether a mining engineer had the right to dispose of a report to parties other than those it was made for, at the same price as would have been originally demanded.

The action was brought by Mr. John Stewart, of Ottawa, against E. V. Wright, also of Ottawa, to recover $288, the balance of $300, which value he placed on a report of the Lake Temiscamingue galena mine then owned by Wright. The defendant submitted that the sum already paid, $22, was ample remuneration, as the reports were not original, but copies.

MR. J. STEWART was the first witness called. Being sworn, he deposed that in December, 1889, he went to the mine at the request of Mr. R. G. Leckie, to report on his own and the adjoining lot owned by Wright, on which he had a 30 day option, in which time he was to pay $50,000 down and the balance later. The time being so short, Mr. Leckie did not purchase the property. It was understood, however, that Mr. Leckie was not bound to take the report—in event of his not buying the mine—in which case witness was to be at liberty to dispose of it elsewhere as best he could. In the following January Wright came to him and said he wanted a report—not the same, but with all reference to Leckie's property left out. This witness supplied from the data in his possession. He was given $10 to pay for the cost of material, and promised more when the mine should be sold. In February he furnished further copies, for which he received $7, and during last autumn he made a sketch of the property, when he received $6. It had taken him three weeks to make the examination and to write the reports, make plans, etc. He considered the work worth $500, including as it did, underground and aboveground surveys and examinations, estimates, etc. Wright had told him that a Mr. Treadwell, an English engineer asked 200 guineas to report on the property. $300 was a moderate charge and he had a perfect right to sell the report.

The mine was sold in March of this year to Mr. B. W. Chapin, president of the Ingersoll Rock Drill Co., of New York, who employed Mr. J. Williams, M.E., to examine it. Mr. Wright had never had another report made on it, and he, witness, was told by Mr. Williams that if it had not been for his report the mine would not have been sold as the snow was on the ground, and William's took Stewart's report and in great measure embodied it in his own; thus gaining at least six months' time,—and, moreover, witness' plans have been used at the mine ever since.

Cross-examined by Mr. Chrysler.

He went on Leckie's account solely. He did not mention his first agreement to Wright. There was a good deal of difference between the two reports, and moreover, he did not charge for changing the plans, but for an expert report. He had also conducted correspondence for Wright with Leckie, informing the latter that a further extension of time would be given or an option of $125,000. The report given to Wright estimated a yearly income of $97,500 from the mine, but witness afterwards wrote to him explaining how the operations could be conducted much more cheaply, so as to give $187,500 a year. He had been for twenty-three years engaged in various branches of mining work.

MR. J. LAINSON-WILLS, F.C.S., was then called and gave evidence that he considered the plans perfectly intelligent. Taking the distance into account, the work was worth $500. The value of a report depended very largely on the reputation and status of the engineer, and Stewart bore a very good name. Fees are for reports solely; out-of-pocket expenses are a separate item and Stewart's should be discharged by Mr. Leckie. Making copies of reports was clerical work, but if the engineer's signature was attached they at once ranked as reports and had the same value.

MR. B. T. A. BELL, editor of the CANADIAN MINING REVIEW, stated that from his acquaintance with expert work, he should judge the reports and plans to be an intelligent and fairly valuable description of the property. He had read the report carefully and it seemed to bear out the general reputation of the Temiscamingue mine. The draughting work was excellent. There was no fixed scale for professional work of this kind, but from $500 to $1,000, was no uncommon figure. Everything depended upon the status and practice of the expert. He had known Stewart for six years and thought he possessed a practical acquaintance with mining work. He would not class the reports as mere copies or clerical work. They had a value and were well worth the amount claimed if used by the vendor in disposing of the mine.

MR. GEORGE GOODWIN, next called, said he had been interested in the mine jointly with Wright. It had been sold to Mr. Chapin of New York. He did not know the exact sum.

MRS. J. STEWART deposed to have heard Mr. Wright tell her husband that he had asked the English engineer, Mr. Treadwell, to examine the property, but that the latter had asked 200 guineas.

E. WRIGHT, the defendant, was then called and, being sworn, deposed that he had employed Stewart in 1890. He asked him for a copy of Leckie's report, plans and tracings, prompted in great part by curiosity to see why Leckie did not take them. Stewart said he could pay him what he (witness) liked, so when he received the report, having a $10 bill in his pocket, he gave it to Stewart, who professed himself satisfied and went off. He afterwards got another copy of the plans, only half as big. He paid about $7 for the second, but though Stewart did not seem satisfied, he asked no special sum. It being thus left to witness, he paid him what he thought was sufficient. The last time he employed witness was last fall when he gave him $5 for a sketch plan of the property to effect some insurance. Then Stewart asked what about the other money? Which was the first mention made of it. The mine was not sold through Stewart's report—the purchaser had an expert who viewed the property. The second report was very little different from the first. He told Stewart he conld do nothing with the report, and the latter said that some of the figures might be altered somewhat, (as was done by letter of March 6, before mentioned).

Cross-examined by Mr. Kidd. The property comprised about 500 acres. He had never had a mining engineer to report upon it. He had tried to sell it before but failed. He sold it (as mentioned) for $127,500. He had expected to give Stewart something, but did not tell him that if he had had his reports before he would have sold the mine sooner. He had never applied to Mr. Treadwell for a report.

G. REIFFENSTEIN, sworn, said he had seen Stewart in October, 1889, and was told by him of the report he had prepared for Leckie. Witness therefore suggested to Wright that he should get a copy of the report. Copies might be worth 25c. a folio. Witness had little or no knowledge of mining matters, and based this valuation on his own work.

Counsel for the defence then addressed the jury and in an able speech endeavored to prove that the reports received by Wright were mere copies and as such should be paid for at copy rates and not at such a preposterous price.

Mr. Kidd, for the plaintiff, following, urged that the work was original and as such it must command its full professional valuation, under the agreement with Leckie.

His Lordship summed up very impartially, though it inclined somewhat to the side of the plaintiff, and the jury left the box.

Verdict was rendered to the plaintiff for the full amount claimed, $288 with costs.

Anglo-Continental Guano Works Co. v. The Emerald Phosphate Company.

This appeal was heard by the Court of Queen's Bench at Montreal on Tuesday the 22nd inst., before Chief Justice Lacoste and Justices Baby, Bossé and Wurtele. Messrs. R. Laflamme, Q.C., and A. E. Cross, Montreal, appeared for the appellant, and T. P. Foran, Aylmer, for the respondent.

The appeal is from a judgment which maintained an injunction, and ordered the appellant to cease from work on certain lots in the Township of Buckingham, County of Ottawa, Quebec, and to desist from the removal of phosphate until the bounds of the respective properties should have been legally defined.

The respondent complained that the appellant was encroaching on its property and removing valuable phosphate of lime.

By its first plea, which is in the nature of an exception to the form, appellant alleged :—That respondent was wrongly described in the writ as having its place of business at Buckingham, as in fact its place of business was in the State of New York ; that respondent's demand was not of a nature to entitle it to the summary procedure applicable to injunctions, and the delay of less than ten days between service and return was therefore insufficient; that the return day was not fixed by order of the judge, and that the affidavit and petition were vague and did not disclose a case for injunction or even allege exposure of respondent to irreparable or serious damage if the writ were not granted.

By its second plea, appellant denied any trespass or work upon lot 19, alleging that its operations were confined to mining upon its own property, lot 18, the mining rights in which it had purchased, and in the development of which it had spent at least $10,000.00 to respondent's knowledge ; and it further pleaded, that neither respondent nor its predecessors had ever taken the necessary steps to have the boundary between the two lots settled, though protested and called upon to do so ; that said boundary still remained unsettled though appellant reserves its right, upon due proceedings being had to fix the boundary, to maintain as the true boundary a line drawn by Edward J. Rainboth, surveyor, in the year 1890 ; that respondent having neglected to have the boundary fixed by proper boundary suit was without right to take the exceptional and rigorous remedy of an injunction ; that the matters complained of were not properly the subject for remedy by injunction, and that the petition or demand did not allege exposnre to irreparable damage or show that injunction was the proper remedy and that the petition was premature.

Appellant also pleaded a general denial.

Respondent answered the first plea or plea to the form, in law by alleging that it was waived because appellant filed pleas to the merits at the same time.

To the second plea respondent answered that in the year 1887 or 1888 the surveyor, Edward J. Rainboth, had surveyed the boundary in question at the request of McIntyre, appellant's predecessor in title, and drawn the line opposite the point where the alleged trespass was committed less than twenty feet further west (that is towards respondent's side) than where George C. Rainboth had drawn the line, and that appellant had trespassed even beyond this line also.

That this line drawn by Edward J. Rainboth was not drawn with legal formalities ; that a change in the survey law cannot alter ownership acquired under former laws ; that respondent had always occupied up to the line drawn by George C. Rainboth, and that appellant assumed the functions of a Court in operating beyond the lines.

Judgment was reserved.

MINING NOTES.

[From Our Own Correspondents.]

Nova Scotia.

Cumberland County.

Work at the different collieries is about as usual at this season.

At Springhill about 1,400 persons are employed, and the daily output averages from 1,500 to 1,700 tons. Since the time of the explosion in February, safety lamps have been introduced and the "Marsaut" is now used exclusively in all the pits. No powder is used in No. 1 slope where the explosion occurred, and in consequence the cost of mining has greatly increased. The miners complain because of the prohibition of the use of powder in certain cases, and a committee has been appointed by the local government to prepare a report on the best flameless explosive for use in gaseous mines. The explosion, however, did not affect the output at the collieries, except for a brief period. Indeed it is doubtful if the output would be so large to-day if the large output of 2,200 tons daily had been kept up, for the reason that the pillars were pretty well exhausted, and sufficient pit room had not been opened up. The levels, however, are now being extended and considerable prospecting is being done. Levels are being driven northerly to test what is known as the Aberdeen seam, aud it is said to be the intention of the company to sink another large slope, or a shaft, as soon as the exploratory work is far enough advanced. It is improbable, however, that a start will be made this season.

Since stoppings have been built in all the tunnels it is necessary to find some means of draining No. 3 slope. Hitherto the water from this slope was conveyed in pipes through a tunnel into No. 2 slope, and thence pumped to the surface by two powerful plunger pumps, built by Allison, of Port Carbon, Pa. Another pump will shortly be put in No. 3 slope, which will then be entirely independent of the others. The column pipes are nine-inch diameter. They are fitted with wooden lining to resist the destructive corrosive qualities of the pit water. The pump and pipes are imported from Janesville, Pa.

At No. 2 slope a new bankhead is being built. It has an elevation of thirty feet, and will be of wood, with a corrugated iron roof. The present building is so low that the coal cannot be screened, and it is to remedy this that the new building has been erected. The trestle supporting the building is constructed of heavy timber.

A difficulty with the workmen's union recently had a threatening look, but a strike was averted by submitting the question in dispute to three arbitrators. They heard both sides and at once decided that the company had no case.

The Joggins colliery—the oldest in Nova Scotia proper —is now working steadily, and the outlook is exceedingly bright. The output averages 300 tons daily, and is steadily increasing. About 250 men and boys are employed. This colliery is now operated by the Canada Coal Co., with considerable success. The system of mining has been changed from the bord and pillar to "longwall." This gives larger coal and is more economical. To the deep the quality of the coal is improving, and the quantity of the coal now being shipped is large, clean and bright. It is growing in public favor, and consequently there is an increased demand. The company now operating the mine is about to erect a number of cottages for the accommodation of their workmen.

Another mine on the line of the Joggins railway, a short distance from Maccan—known as the Lawson pit—which was worked in a small way to supply the local demand, is now closed down temporarily. All the buildings, including the engine house, were recently destroyed by fire. The engine was considerably damaged, and the loss is $6,000. Mr. J. T. Smith, of Amherst, was the owner.

The Chignecto colliery, near Maccan station, owned by the Londonderry Iron Company, has been abandoned. The colliery has been idle for some time, owing to the coal having been exhausted, and all the pillars have since been drawn.

A diamond drill is boring on areas near Maccan station, and it is expected that a workable seam of coal will be found to the deep. It is believed that the Joggins seams extend in that direction.

Copper has been found near Minudie, about three miles rom the Joggins. A company has been organized, and the district will be thoroughly explored. The owners assert that the ore can be extracted in paying quantities.

Asbestos has been found at Five Islands, just on the boundary between Cumberland and Colchester counties. The discovery was accidentally made by Mr. G. Gilling. Several Americans are negotiating for the purchase of the property.

Cape Breton.

The output of coal from the Island this year will be greater than in any previous year, all the mines being taxed to their utmost capacity. An estimate places the quantity in the vicinity of 1,000,000, as against 800,000 tons last year.

The Electric Company of Amherst, N.S., have shipped to the Gardner Mining Company, Sydney, a thirty horse power dynamo and apparatus to run an electric coal cutting machine. This is the second system of the kind in the Dominion, the other being the Jeffrey machine, now used in British Columbia.

Pictou County.

The Drummond colliery is at present being worked steadily. The management has curtailed boy and horse labor very much, by a system of endless rope haulage underground which gives great satisfaction. These run on the levels with 22 boxes and on the slope with 11 boxes.

The annual meeting of the New Glasgow Coal, Iron and Railway company was held during the month. Quite a number of shareholders were present. Messrs. Stein and Schwartz, the company's engineers, reported the work of furnace construction well under way, the foundations being nearly all in, the greater part of the materials on the ground, and everything looking favorable for the furnace being in full blast early in the spring of 1892. Mr. Chambers reported the railway construction well in hand, seven miles being ready for the rails, and the remainder will be ready by October 1st. The mines being worked are showing very large quantities of ore, and are constantly, as the working development goes forward, increasing in value, and proving more conclusive than ever that the company possesses abundance of ore for all their purposes. The capital stock of the company has nearly all been taken up and the first two calls paid thereon.

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Quebec.

Miscellaneous.

Messrs. Walsh and Mulvena, of Sherbrooke, show samples of very good fibre from their asbestos property near East Broughton. Development is reported satisfactory.

Apatite has been discovered on the property of the Radnor Forge company at St. Maurice. Mr. Obalski, the Government engineer reports the quality quite equal to that raised in the Ottawa valley.

Some promising deposits of Muscovite mica of excellent quality have been recently uncovered in the Township of Bergeron, Escoumains and Tadousac, in the County of Saugenay.

Ottawa Valley.

The High Rock mines continue to lead in the production of phosphate, their agents reporting shipments averaging from 1,300 to 1,500 tons per month. One hundred and fifty men are employed at mines.

There is little or nothing to report from the other mines, the most of which, in view of continued depression in the market, high freights and the imposition of a burdensome tax, will very shortly be closed down for the winter.

Rumors are current that the North Star, the Shirley grinding mill at Buckingham, with the super-phosphate works at Capelton, will shortly pass into the hands of an English syndicate. We hope to give fuller particulars later.

Mr. P. Würzburger, M.E., Antwerp, consulting engineer for the Anglo-Continental Guano Works Co., is at present making an examination of the Squaw Hill and Etna mines owned by the company. Mr. Würzburger will also visit the Florida mines in the interest of a Hamburg company.

Black Lake District.

Mr. A. H. Murphy is opening several new pits on lot 32, range B. Three new derricks have been erected and the drift and clay is being removed.

Mr. Douglas, representing Glasgow capitalists, has been making an examination of the property owned by the Thetford Mining Co., with a view to purchase.

The Anglo-Canadian Asbestos company are working a number of pits on their property and a larger output than last year is reported. This company are also erecting a larger cobbing house.

The Glasgow and Montreal Asbestos company, formerly the Scottish-Canadian, is working a large force of men ; output to date reported excellent. The finest asbestos this property has yet yielded, has been taken from a pit recently opened at the bottom of their property near the Ireland and Coleraine line. A steam hoist and derrick is the latest acquisition to a well arranged plant.

The property of the United Asbestos company, under the energetic direction of Mr. John Penhale, is developing nicely with usual complement of men.

New hoisting mechinery has been installed on the hill, by the American Asbestos Co. The works on the property reflect the highest credit on Mr. E. Wertheim, and his able and genial engineer, Mr. L. A. Klein. The stock of crude, fibrized material on hand, attests to the productiveness of their various pits.

The Laurier Mining company has lately resumed working on their property.

A derrick and horse power has been put in by the Central Co.

The finishings of the new Asbestos Club's rooms, although not yet quite complete, are in excellent taste and reflect credit on the executive. The secretary, Mr. Evans, desires to convey the obligations of the club to the ladies and gentlemen who so materially assisted them by their efforts at the recent concert, particularly the Misses Penhale, Crabtree, Barbour and Beauchesne. It gives us great pleasure to announce that a handsome sum was realized.

A full report of the proceedings at the opening meeting and its successful and thoroughly enjoyable supper will be found in another place. The occasion will live long in the memory of those who had the privilege of being present—particularly at the dancing and its subsequent "pow-wow."

As announced elsewhere all the mines in this district will close down on 1st November until further notice.

Thetford Mines.

The Beaver Asbestos company have added a fine new 80 h. p. boiler to their plant. A new cable derrick has also been put in at pit.

The Jenckes Machine company have lately furnished the Bell's company with a pair of 80 h.p. boilers.

Danville.

The mine operated by Mr. W. H. Jeffrey in this district, continues to maintain its reputation as one of the best of our asbestos producers. The mine has been equipped with a new and improved plant.

Ontario.

Belmont Township.

The Belmont Bessemer Ore Co. of New York, have been working steadily for the last six months on their magnetic iron mine in Belmont Township, with a force of about 20 men. So far they have been doing preliminary and development work only. A shaft has been sunk to the depth of about 50 feet, mostly through good ore, and several cross-cuts have been made, showing ore of excellent quality.

The company have decided to construct a branch railway from their mine to the C.P.R., about six miles, and have commenced the necessary work. Mr. G. L. Woodworth, M.E., late of the Iron River mine in Michigan, is the manager.

Perth District.

The Anglo-Canadian Phosphate company will close down next month for the winter.

Kingston.

The Foxton Mining company has closed down *pro tem.*

Manitoba and North-West Territories.

General Superintendent White, of the Canadian Pacific Railway, has returned to Winnipeg, after inspecting the lines under his supervision west of Winnipeg. He first went over the Souris branch to Melita, and drove thence to the coal fields, for the purqose of making personal observations of the country through which the Sou.is line is being constructed. He afterwards went to Donald, the end of his division, and made calls at Canmore and Anthracite, where he visited the coal mines. Mr. White says that the Souris railway will be completed with due despatch to the coal fields, and it is expected that the promised cheap coal will be in the market by February 1st, at the latest. The mines will be located some distance west of Alameda, the drilling tests made at that place having proven unsuccessful. Experienced miners will be brought from Pennsylvania to develop the mines. Mr. White states that there is great activity at Anthracite, work having been resumed in the mines there under new and energetic management. One hundred and thirty men are employed in the mines, and preparations are being made to ship coal to Winnipeg and the coast. Shipments will also be made to Spokane Falls, in Washington, by way of the Columbia river. The coal that is now being mined at Anthracite is said to be fully equal in quality to the Pennsylvania coal. Compared to the Pennsylvania coal, analytical tests show that it contains as much fixed carbon and more volatile matter, and consequently leaves less ashes after burning.

The discovery of new deposits of anthracite coal in the Province of Alberta, comprising a portion of what was formerly known as the North-West Territory of the Dominion of Canada, will prove, if reports are correct, highly important, not only to Manitoba and British Columbia, but also to the Pacific Coast States of this country, there being no import duty on anthracite coal. It is said that large seams of this coal have been found along the Red Deer River, forty miles north of Banff. Hitherto it has been supposed that the only anthracite coal in Canada was at Anthracite, near Banff, from which place the present supply for the western part of the Dominion is taken.

British Columbia.

Kootenai District.

The Revelstoke smelter, after making a short run, has been closed down until such times as a supply of ore can be obtained. The ore from the Monarch mine, at Field, was found to be too refractory to work to advantage, the furnace "freezing" twice in running through a few tons. Afterwards 81 tons of good ore were treated successfully. President and Mrs. Boyle left Nelson, on Thursday, expecting to sail from New York on September 1st for their home in London. They will return to Kootenai in the spring.

Vancouver Island.

It is reported, upon what is believed to be good authority, that Hon. C. E. Pooley, Q.C., secretary of the Esquimalt and Nanaimo Railway company, British Columbia, and Mr. D. R. Harris, will leave for England in the course of a few days, to complete the sale of the Wellington collieries, the property of R. Dunsmuir & Sons, to an English syndicate. The price named is two and a half millions, and, for this amount of money, it is understood that all the valuable coal area at Wellington, the collieries, docks at Departure Bay, shipping owned by the Dunsmuirs, and employed for coal carrying, etc., will be conveyed to the purchaser. The E. and N. railway and the vast tract of timber, mineral and agricultural land known as the Island railway grant, and estimated to contain over 1,500,000 acres, will not, of course, be included in the sale at the figures mentioned. The total value of the railway and the lands referred to would aggregate not less than $10,000,000. The proposed sale of the collieries has been mooted for several months past, and it is more than likely that the deal, which will, perhaps, be the biggest sale of private property ever accomplished in Canada, will be completed upon the visit of Messrs. Pooley and Harris to England.

CANADIAN COMPANIES.

The Scottish-Canadian Asbestos Company.—A meeting of the creditors and shareholders of this company will be held in the office of Hanson Bros., Temple Building, St. James street, Montreal, at 2 p.m., on October 7, for the purpose of receiving and considering the cash statement and first dividend sheet, etc.

The Northey Manufacturing Company, (Ltd.)—This company will apply for incorporation under Federal laws, for the purpose of manufacturing and dealing in pumps, engines, boilers, machinery, etc. Head office, Toronto. Capital stock, $100,000 in 1,000 shares of $100 each. Applicants, J. P. Northey, J. Leys, A. Brindley Lee, A. Burdette Lee, and H. S. Pell, all of Toronto; all of whom are to be the first directors.

The Lunenburg Iron Company, (Ltd.)—Will apply for incorporation under Nova Scotia laws, for the purpose of casting and manufacturing iron and other metals, stoves, etc. Head office, Lunenburg, N.S. Capital stock, $10,000 in 200 shares of $50 each. Applicants, W. T. Lindsay, C. E. Patterson, P. T. B. Harris, W. Saunders, and S. A. Chesley, Lunenburg; of whom the first three are to be the first directors.

The Robb Engineering Company, (Ltd.)—This company is applying for incorporation under the Nova Scotia Act, for the purpose of carrying on the business of iron and brass founding and general engineering and the manufacture of all kinds of machinery, engines, boilers and pumps. Head office, Amherst, N.S. Capital stock, $249,900, in 2,499 shares of $100 each. Applicants, D. W. Robb, F. B. Robb, W. R. Robb, A. G. Robb and Dame Margaret A. McGregor, all of Amherst; all of whom are to be the first directors.

The Steveston Natural Gas and Development Company, (Ltd.)—Application will be made by this company for incorporation under the British Columbia Act, with power to dig, bore and mine in and about the town site of Steveston and elsewhere in British Columbia, for natural gas, petroleum, coal, mineral water, or any other natural commodity, or to acquire such properties by purchase or otherwise. Head office, Vancouver, B.C. Capital stock, $50,000 in 500 shares of $100 each. Applicants, W. H. Steves, A. M. Beattie, H. F. Keefer, J. W. Vaughan, D. McGillivray, Vancouver, all of whom are to be the first directors.

The North Vancouver Land and Improvement Company, (Ltd.)—This company will apply for incorporation under the British Columbia Act for the purpose of acquiring by purchase or otherwise, coal lands and coal mines, mineral claims and mines of every description, and to work, lease or dispose of same, with other powers in respect of real estate, the building of railroads, etc. Head office, Vancouver, B.C. Capital stock, $500,000, in 5,000 shares of $100 each. Applicants, H. A. Jones, Johann Wulffsohn, and E. Mahon, Vancouver; all of whom are to be the first directors.

The Canada Coal Company, (Ltd.)—Will apply for incorporation under the Nova Scotia Act, in order to mine, quarry, work and win by any process, coal, iron, stone, or other minerals or mineral substances, and generally to carry on the business of coal owners, ore and metal dealers, etc., with other powers. Head office, Joggins, Cumberland Co., N.S. Capital stock, $50,000, in 5,000 shares of $10 each. Applicants, R. Cruikshank, Hon. J. Boyd, St. John, N.B.; R. G. Leckie, C.E., Londonderry, N.S., D. McPherson, and S. M. Brookfield, Halifax, N.S.; all of whom are to be the first directors.

The Electric Mining Company, (Ltd.)—Application will be made for incorporation under Dominion regulations, by the above company, for the purpose of carrying on phosphate and other mining works in the provinces of Ontario and Quebec, and to buy and sell and deal in mines and minerals; to erect works for the manufacture of sulphuric and other acid, and for testing phosphate and manufacturing superphosphate of lime; to prospect for and work or deal in any mines or mineral lands, with other powers. Head office, Ottawa. Capital stock, $125,000, in 1,250 shares of $100 each. Applicants, Hector McRae, J. W. McRae, A. Stewart, J. Nicholson and F. H. Chrysler, all of Ottawa; of whom H. McRae, J. W. McRae and A. Stewart, are to be the first directors.

The Coleraine Mining Company, (Ltd.)—Application will be made by the above company for incorporation under Federal laws, for the purpose of buying, selling, dealing in, and working mines and minerals, the reducing and smelting of ores and the manufacture of articles and products from minerals; with power to erect plants, etc. Head office, Montreal. Capital stock, $120,000, in 1,200 shares of $100 each. Applicants, Hon. J. A. Chapleau, Ottawa; A. Desjardins, A. L. DeMartigny, Hon. A. Lacoste and Dame D. J. Dansereau, all of Montreal; of whom the first four are to be the first directors.

The Sault Ste. Marie Nickel Mining and Contract Company, (Ltd.)—This company will apply for incorporation under Ontario laws, to carry on the business of exploring, developing, mining and treating nickel and other ores and mineral substances, to deal in, buy, sell or lease, mineral properties and establish agencies in the United States and Great Britain for the sale of mineral, timber, agricultural and other lands; operations are to be carried on in the Township of Drury and elsewhere. Head office, Sault Ste. Marie, Ont. Capital stock, $45,000 in 9,000 shares of $5 each. Applicants, J. McKay, J. Dawson and D. M. Brodie, Sault Ste. Marie, Ont.; E. S. B. Sutton, L. F. Bedford, Saulte Ste. Marie, Mich.

Glasgow and Montreal Asbestos Company, (Ltd.)—Registered in Scotland, with a capital of £70,000, divided into 35,000 preferred and 36,000 deferred shares of £1 each. The offices are at 68, St. Vincent street, Glasgow. Object, to adopt and carry out an agreement with Robert Gaston Aitken, chartered accountant and stockbroker, in Glasgow, providing for the purchase by the company of the properties, mining rights, and others, including the Martin Mines, in the township of Coleraine, and county of Megantic, and the Fraser Mines, in the township of Broughton and county of Beauce, both in the Province of Quebec, with all the mining machinery, plant, tools, and other personal property, and the whole other rights, members, and appurtenances; to carry on the business of asbestos producers, manufacturers, and merchants, of a mineral or mining company in all its branches.

Montreal Nut-Lock and Manufacturing Company, (Ltd.)—Application for incorporation under the Quebec Act, will be made by the above company, to make nut-locks, bolts, rivets and other articles. Head office, Montreal. Capital stock, $110,000, in 10,000 shares of $10. Applicants, J. R. Wilson, L. H. Young, A. H. Holden, G. C. Arnoldi, J. Abbott, F. A. Draper, D. A. McCasgill, Montreal, and H. W. Leslie, New Glasgow.

The Moir Granite Company.—This company will apply for incorporation under Quebec laws, for the purpose of quarrying and dealing in granite and other stone. Head office, Stanstead, P.Q. Capital stock, $100,000, in 4,000 shares of $25 each. Applicants, W. D. Moir, Stanstead; E. G. Miller, Beebe Plain; G. H. House, Beebe Plain; S. Stevens, Stanstead Plain; D. W. Davis, Derby Line, Vt.; J. H. Lang, Boston; and D. S. House, Beebe Plain; of whom the first five are to be the first directors.

The Superior Natural Gas Company of Ontario, (Ltd.)—This company will make application for incorporation under Ontario laws, to bore for and obtain natural gas, oil, salt, or any other natural commodity; to construct and operate pipe lines, and erect plant, refineries, etc, for treating the same, with other customary powers. Head office, Sherkston, Welland Co. Capital stock, $100,000, in 5,000 shares of $20 each. Applicants, S. Carroll, Sherkston; W. E. Carroll, G. Bork, G. Lang, J. Binz, A. W. Hickman, E. G. S. Miller, Buffalo, N.Y.; and H. Cronmiller, Port Colborne, Ont., of whom S. Carroll, J. Binz, and H. Cronmiller are to be the first directors.

The International Mining and Milling Company of British Columbia, (Ltd.)—This company will apply for incorporation under the British Columbia Act, in order to acquire certain mines and mining properties situate at the North Fork of the Kettle River, B.C., known as the "Ophir," the "Lynden," the "Dominion," the "Union," and the "Volcanic Mountain" claims, and to otherwise deal in other lands and claims; to carry on the business of miners, smelters, etc., with other customary powers. Head office, Company's mines at North Fork of Kettle River, Osoyoos Division of Yale District, B.C. Capital stock, $500,000 in 500,000 shares of $1 each. Applicants John L. Broe, W. C. Kincaid, J. L. Wilson, R. A. Brown, B. M. Spinning, J. C. Kincaid, Victoria, B.C.; of whom R. A. Brown, J. L. Broe and J. L. Wilson shall be the first directors.

Montreal and Kootenay Mining Company, (Ltd).—A company under this title will shortly apply for charter of incorporation under Dominion laws, respecting Joint Stock Companies. Capital stock, $20,000. Directors: E. B. Greenshields, R. T. Hopper, W. H. Irwin, R. A. Peterson, F. Fairman, J. W. Smith, all of the city of Montreal. The property to be operated is the Tam O'Shanter argentiferous-galena claim located near Ainsworth in the Kootenai district, Province of British Columbia. Assays from the workings are reported high in silver. A small force is at present working on this claim.

Thetford Mining Company.—The asbestos lands owned by this company in the Black Lake district, Province of Quebec, are reported to have been sold to Glasgow capitalists.

The Mycenian Marble Company of Canada, (Ltd.)—Notice of application for a charter of incorporation under Dominion laws, is made on behalf of this company by Messrs. Pearson and McDonald, Toronto. Authorized capital stock, $100,000, composed of 1,000 shares of $100. Head office, Toronto, Ont. Directors, J. Yorke, builder; J. C. Mellechamp, manufacturer; Walter Gaynor, broker; Henry Meade, gentleman; John L. Davison, physician; R. B. Hamilton, F. F. Manly, J. E. Elliott, J. G. Gibson and James Pearson, all of Toronto. Formed to purchase patent No. 35,696, of the Dominion of Canada, being a new and improved method of manufacturing marble called "Mycenian marble," obtained by Richard Guelton, the inventor, and to manufacture all kinds of artificial marble, capable of being manufactured under said patent or under any other process.

Alberta Railway and Coal Company.—The annual meeting of shareholders will be held on Wednesday, 23rd October, at the offices of the company, 37 Old Jewry, London.

Bertie Natural Gas Company. — Supplementary letters patent have been granted under date of 2nd Sept., whereby the capital stock of this company has been increased from $2,000 to $50,000.

The Oil and Gas Company of Comber, Ont. — Charter of incorporation under date of 9th September has been granted to J. A. Buchanan, A. Ludlam, Moses Creighton, James Sellers, William Harmer, John T. Jordan, R. O. F. Ainslie, Wm. Mann, James Kerr, C. N. Anderson, R. H. Abbott, T. F. Johnson and S. T. Anderson, all of Comber, in the County of Essex, Province of Ontario, under title of company as above. Authorized capital $3,000, divided into 150 shares of $20.

The Chicago-Algoma Nickel Company, (Ltd.)—This company gives notice of application for charter under Ontario laws. Capital stock $1,000,000, divided into 10,000 shares of $100. $300,000 of said stock to be first preference, on which a dividend or dividends aggregating $90,000 on such stock shall first be paid out of profits, but ever thereafter, the holders of said stock shall not be entitled to any further or greater dividends than those allowed on ordinary stock. Applicants: R. P. Travers and Henry R. Durkey, Chicago; A. F. Mason, Boston; T. L. Nelson, Boston; F. A. Whitney, Leominster, U.S.A.; H. R. Valpey, Boston; T. Travers, Township of Drury, Ont. Formed to acquire and operate mining lands in the Township of Drury, district of Algoma, Ont.

The Westminster Slate Co. (Ltd.)—This Company has applied to the Chief Commissioner of Lands and Works to purchase certain lands containing 160 acres at Deserted Bay, Jerves Inlet, B.C.

The Carbonate Mountain Mining Co. (Ltd.)—This Company gives notice of application for charter under Companies Act of B.C. Head office, Vancouver, B.C.; capital stock, $100,000, divided into 100,000 shares of one dollar. The Trustees are: Charles Wetham, E. E. Rand and C. D. Rand, all of Vancouver, B.C.

The Lanark Consolidated Mining and Smelting Co. (Ltd.)—This Company gives notice of application for a charter of incorporation under the Companies Act of B.C. Object: to acquire the rights and interests of his Selkirk Mining and Smelting Co., (Ltd.) in and to the Lanark mine, the Red Fox, the Isabella mine, the Dorothy mine, the Sutton mine and the Sprague mine, and all and every the other real and personal property of the said Selkirk Mining and Smelting Co., lying at or near the Town of Illecillewaet, West Kootenai District, for the sum of $120,000, to be paid for in fully paid up shares of the Lanark Consolidated Mining and Smelting Co. (Ltd.); Capital Stock, $200,000 in 8,000 shares of $25 each; Directors: Thos. Earle, W. J. Goepel, F. S. Barnard, A. J. Beaulands and N. P. Snowdon; Head Office, Victoria, B.C.

The Vancouver Stone-Quarrying, Mining and Transportation Co. (Ltd.)—This Company has applied for charter under laws of British Columbia, with the object of searching for and mining stone, coal and other minerals. Capital Stock, $25,000 in 2,500 shares of $10 each; Head Office, Cardova Street, Vancouver, B.C.; Directors: J. W. Vaughan, J. Wulffson, J. T. Carrol and J. A. Green,

Canadian Manganese.

In that very comprehensive report on the subject of Manganese: its uses, ores and deposits, prepared by Dr. R. A. F. Penrose, Jr., and just published under the auspices of the Geological Survey of Arkansas, much information of great value is given on the subject of Canadian deposits. Dr. Penrose says:—

"The uses of the manganese ores of New Brunswick and Nova Scotia differ from the uses of the larger part of the manganese ores of the United States, in that the former are devoted mostly to chemical purposes, while the latter are largely consumed in the manufacture of spiegeleisen and ferro-manganese.

The manganese ore used for chemical purposes has a much greater value than that used for spiegeleisen and ferro-manganese. It sells for from 2 to 5 cents per pound, or from $40 to $100 per ton, according to quality, while that used for the latter purposes rarely brings over $15 per ton. The applicability of an ore for either use depends on its composition; its value for chemical purposes is based largely on its oxidizing power, that is, on the amount of oxygen known as 'available oxygen' that can be obtained from it in the ordinary processes of manufacture. The available oxygen, as explained in previous chapters, depends on the amount of manganese peroxide in it, and, therefore, the market price of an ore for chemical purposes is determined by the percentage of this constituent. Pyrolusite contains a larger percentage of peroxide than any of the other manganese ores, in fact, being, when pure, composed entirely of it, and therefore, the value of the Canadian ores is due mostly to the large proportion of this mineral found in them. Pyrolusite is never found in a perfectly pure state in nature, however, and the very best picked ore rarely contains more than from 70 to 95 per cent. of peroxide, equal to about 13 to 17 per cent. of available oxygen.

Psilomelane also contains a considerable proportion of peroxide, but on account of its hardness and other peculiarities, as already explained on page 42, it is not so desirable as pyrolusite for most chemical purposes. Manganite, on the other hand, has only a small percentage of peroxide;* while wad, though it frequently contains a considerable amount, is too impure to be desirable for chemical purposes.

In the manufacture of spiegeleisen and ferro-manganese, the amount of available oxygen is not an item in the valuation of the ore. For these purposes, the three main requisites are a high percentage of manganese and a low percentage of silica and of phorphorus. Hence the manganese ores of the United States, which usually contain a smaller proportion of pyrolusite than the New Brunswick and Nova Scotia ores, but often fill all the requirements for spiegeleisen and ferro-manganese, are used for the manufacture of these materials. Small quantities, however, are sorted out and sold for chemical purposes.

At present most of the Canadian ore is used as a reagent in glass making, in electric batteries, in the manufacture of chlorine and disinfectants, as a dryer in varnishes, and for other chemical purposes. The use as a reagent in the manufacture of chlorine is one of the largest chemical sources of consumption of manganese, but the best grades of Canadian ores are too high priced to be employed for this purpose, their greatest value being in glass making. For this purpose the freedom of the ore from iron is a necessary quality, and the purity of much of the Canadian manganese renders it especially well adapted for this use.

It is the adaptibility of the Canadian ores for the above mentioned purposes, and consequently their high price, that permits them to be worked, as they do not occur in quantities sufficient to be profitably mined as a source of spiegeleisen and ferro-manganese alone. The poorer grades of ores, however, which are mined in connection with the better ones, are shipped under the name of 'furnace ore,' and are sold at the regular price of ores for spiegeleisen and ferro-manganese.

Tempering Steel Tools for Mining Purposes.

Chisels, drills and picks require careful treatment in sharpening and tempering. The student ought first to know that steel is a compound of iron and carbon; indeed it partakes more of the character of an alloy than of a compound. So much is this the case that when some varieties of pig iron are examined the graphite or carbon may be seen as a distinctly separate crystallisation. Cast iron contains from 2 to 5 per cent. of carbon, and steel contains from 3 to 1·8 per cent. Carbon is removed from cast iron by oxidation, cast iron being melted in the puddling furnace bottom and rabbled by the puddler in such a way that the surface of the metal is constantly exposed to the oxidising influence of the atmosphere when the carbon is burnt out, leaving malleable iron in the furnace bottom. Indeed it may be said of iron that it is easily carbonised and easily decarbonized. This being the case, the smith has to exercise very great care in heating steel for sharpening purposes. If the temperature be too high the steel is decarbonised and rendered worthless. Tools ought not to be heated to more than blood-red, and quickly hammered into the required shape. During the process of tempering steel, if the skin of the tool be cleaned, certain colors are seen which denote the molecular change going on at different temperatures. To understand this clearly, take a bar of steel with a clean skin, which has previously been made very hard by plunging it into the water when red-hot, and slowly heat it, when a wave of straw color will pass over the surface; next, on a further increase of temperature the straw will change into purple, and still further heating, the purple will change into a blue color. Now each of these colors is an index of the different degrees of hardness, the straw being hard, the purple less so, and the blue moderate hardness; that is supposing the bar of steel to be immediately cooled at the moment the particular color is seen. In cooling off a tool, care must be taken not to fracture. This may be illustrated with a common glass bottle. Set a bottle into a dish and carefully pour boiling water into the dish until the bottle is immersed to a depth of 2 inches; if the bottle be now taken out of the dish and be slightly tapped, the bottom will fall off, because a line of fracture has been produced; the expansion of the heated molecules of the glass have torn themselves asunder from the cold or unexpanded molecules; precisely the same thing occurs with steel if heated or cooled carelessly. On tempering a drill or chisel if the chisel be held steady with a certain line coinciding with the surface of the water, the chisel will break at that line when it is put to use, but a thoughtful temperer gives the tools an upward and downward motion in the water when cooling oft, so as not to produce a line of fracture. Mining tools of all kinds ought to be tempered in coal tar and not in water, the tar being a bad conductor of heat is less apt than water to produce a line of fracture, besides the chemical action is such that the tar restores the carbon lost by heating in the fire.

Tool Sharpening Machine.

We notice the introduction of a compact little machine, which promises to supersede the use of the oil stone for sharpenig plane-irons, chisels, and other carpenters' tools. The apparatus, which can be fixed to a corner of the work bench or shop board, consists of a small cylinder on rollers, supported by two standards in a horizontal position, and provided with a handle, by which it is made to revolve. The surface of the cylinder is first covered with oil, and a little powdered emery or knife polish is then sprinkled over the rollers. The plane-iron or chisel is held vertically against the rest or back of the machine, with its edge downwards, and gently pressed against the roller by the left hand of the operator, who simultaneously causes the cylinder to revolve by turning the handle with the right hand. The back or rest against which the tool is held, being worked in slots, can be adjusted to any bevel required. The appliance is so easy and simple that a boy can sharpen a plane-iron, and make sure of having a straight and true edge, in less time than an experienced workman could do it on a stone.

Patent Valve or Draw-off Tap.

This novelty is designed with a view to provide an efficient cock, easy to repair, without involving the necessity of shutting off the water from either main, boiler or cistern. The action of a half-turn of the lever handle, from right to left, opens the valve fullway, by reason of the quick thread on the inner plug, or *vice versa;* and in case of repair, by unscrewing the cap, and screwing down the plug, on the upper setting, the water way is closed, enabling the inner plug and jumper to be removed and fitted with a new washer, thereby rendering the valve as sound and good as new, and at an infinitesimal cost for material and labour. The solid plug which shuts off the water in case of repair also acts as a regulator in case of excessive pressure.

◆

What a Pound of Coal Represents.—A curious and interesting calculation has been made by Professor Rogers, of Washington, on the dynamic power of coal. According to the professor a single pound of good steam coal has within it dynamic power equivalent to the work of one man for one day. Three tons of the same coal represents a man's labour for the period of twenty years, and one square mile of a seam of coal, having a depth of four feet only, represents as much work as one million men can perform in twenty years. Such calculations as the above serve to remind us how very wasteful our methods of burning fuel are, in spite of the efforts of inventors in the direction of economy.—*Iron.*

◆

New Centering Machine.—The chief improvement noticeable in this new appliance consists in the machine being provided with two sensitive balanced spindles for drilling and countersinking at one setting of the work, which can be driven at different speeds by a single belt. It has positive stops, which are so arranged as to secure perfect uniformity in the depth of the work, and actually prevent countersinking too deep. A feeding lever successively advances the spindles to their respective cuts. This lever, which is always in the same position, has the same direction of feeding motion for both spindles. The latter, which cannot be advanced except at the central point, are moved into position by the ball handle. The vice is a well made scroll chuck with hardened jaws, this form of chuck being considered easier to keep true and in alignment with the spindles than other forms. A support is provided for the front end of the bar while it is being inserted in the chuck, as well as a V-shaped rest for the rear end. The advantage of this is that the chuck is made self-centring, and the machine does not have to support the weight of the work while guiding it between the jaws.

◆

Patent Fire Kindler.—This novel and effective appliance for utilising petroleum in lighting fires, is, we believe, of Colonial origin, and known as Chapman's patent. The "lighter" consists of a bulb of some substance very like asbestos, to which is attached a handle of twisted wire. The cylinder serves as a receptacle for petroleum and for the immersion of the bulb, the porous nature of which allows it to absorb sufficient oil to kindle a coal fire without the use of wood, or to boil a small quantity of water in a few seconds, the flame usually burning fiercely for some five or six minutes. In case it should be necessary to light several fires in succession, the bulb may be instantly recharged by plunging it smoking hot into the petroleum without risk of igniting or exploding the oil.

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* Manganite is a hydrous sesquioxide of manganese and, accurately speaking, contains no manganese peroxide; but what is meant here is simply the amount of available oxygen expressed in a commercial sense in terms of "peroxide." Manganite when perfectly pure, contains about 9 per cent. of available oxygen, equal to about 49 per cent. of peroxide, but it is never found in large quantities in this degree of purity.

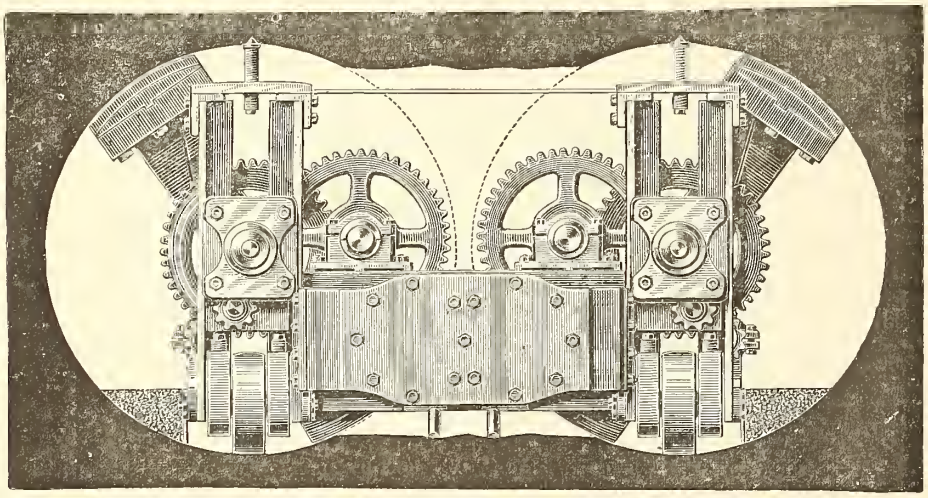
MACHINERY MECHANICS & INVENTIONS

Stanley's Patent Coal Heading Machines.

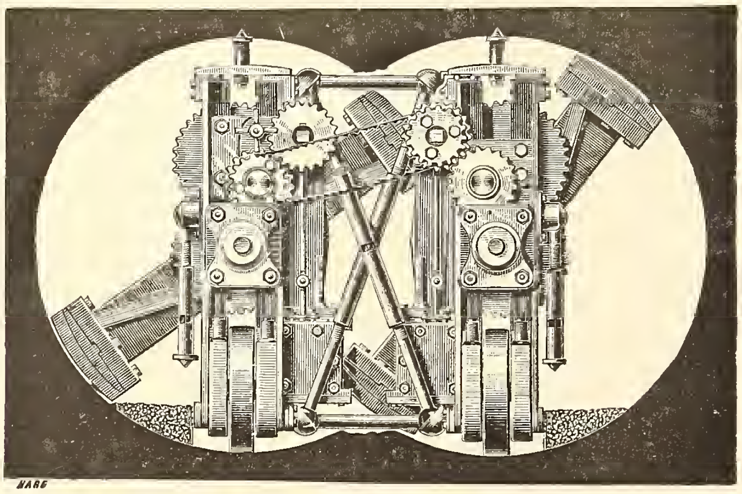
These machines are the invention of Mr. Reginald Stanley, of Nuneaton, England, who has had the advantage of being identified with collieries and engineering works, and accordingly possesses practical mining and mechanical experience.

They have for some years been working under most varied circumstances and have successfully stood the most severe tests to which they have been subjected, proving themselves to be perfectly adapted for the purpose for which designed.

The patentee has been awarded the only medal granted in Great Britain for coal tunnelling, and to-day, they are the only tunnelling machines known to be working successfully in coal seams anywhere. At the present time they are being extensively used at a number of collieries in Great Britain and the Colonies, in the United States, and in several continental countries.



The principle and action of the machine will probably be gathered with sufficient clearness from accompanying figures, together with this description. The machine travels on two broad central tandem wheels running on the floor of the heading, being steadied by a side wheel, visible just above the cylinders. When the bottom of the heading is soft, iron plates of the shape of the heading, which slide forward with the machine, are substituted for the wheels. The machine consists mainly of a central shaft carrying radial and horizontal arms, to which are attached the cutters. These cutters cut an annular groove round the face of the heading, leaving a core which either falls away or is got off as the work proceeds. To get rid of this coal there is no necessity to run the machine back, the heading affording room for men to travel and handle lumps of coal quite as large as can be loaded into tubs.



There are two sets of gearing provided; the front set causing the shaft and the arms to revolve, and the back set serving to advance the frame of the machine, which is built of angle iron, and with engine and gearing attached, weighs from 35 cwt. upwards. The back gearing consists of a cog-wheel with threaded gun-metal bush, fitted into its bosh, which works on the threaded part of the central shaft. It is held to the frame and driven by a sliding cog wheel on the crank shaft, the cutting gear being thrown out. When it is set in motion, the frame is caused to advance on the shaft, or if the machine has been run forward, the back gearing is thrown out, and the front or driving gearing thrown in, and the central shaft and arms then advance in the front and do the cutting. The advantage of the frame advancing on the shaft while the arms and cutters are fixed in the drift, will be at once apparent, the direction of the heading being kept and everything being ready for another cutting as soon as the frame has been fixed.

On either side of the machine are two telescopic screw pins which hold the frame while the annular groove is being cut. The machine being up at the face of the drift and fixed ready for work, the cuttings are brought back by the scrapers, and a man at the back of the machine easily takes them towards him while the arms are revolving.

When the arms have advanced sufficiently to allow of his doing so, the man moves to the front of the machine and, changing his raker for a shovel, throws the cuttings to the back where a second man loads them into tubs, or throws them clear of the machine.

Small lumps that fall from the face while the cutting is proceeding, are dealt with in the same manner without stopping the arms, but for large lumps, or when the core breaks down, the air is shut off while the coal is disposed of. In most seams the core breaks down every foot or so, and with proper diligence on the part of the workman it is soon got rid of, but of course the capacity of the machine—by which we mean its power of driving—depends largely upon the manual energy displayed at this point; as regards the actual operation of cutting, that is very soon accomplished. When the arms have worked out to their full extent—namely, between 3 and 4 feet, the engines are stopped, and by means of the back or the propelling gear, already referred to, the frame is advanced and fixed, ready for another cutting. The time occupied in running forward and fixing varies from 5 to 10 minutes.

The machine is easily moved; being put together with bolts, can (when travelling roads are low, or for other reasons), be taken to pieces, transferred to where it is required, and firmly put together again in a very short time.

The machine will cut through the hardest coal with ease, and such material as shale and fire-clay without difficulty; a machine of greater power and slower travel of cutters is made for working in seams containing strong or sandy-bind, gritty church, or thin bands of stone.

A double machine (see fig. 2), is also constructed for use where the roads are required unusually wide, or in thin seams of coal, the extra width affording greater convenience for getting at and removing the coal from the face, and allows of a double train being lain where requisite.

This machine, which is largely adopted in the principal collieries of Great Britain, cuts the road 70% to 100% wider than the height, and travels forward as fast, and in some cases faster, than the single machine. It can be made to cut a head any size, from a metre in height to two metres in width.

For the same purpose two single machines, coupled together (see fig. 3), can be supplied. The advantage of this system being that they can at any time be uncoupled and used separately.

The speed at which the heading can be driven in pure coal, averages about four times that of hand labour, and the cost is very much less. In seams of average hardness two-thirds of the material produced is round coal, this being a great advantage as compared with hand labour, and going far towards paying the expense of heading.

The heading ensures great safety in working fiery seams by rendering the use of explosives unnecessary, and when compressed air is used, produces a supply of fresh and cool air to the back of the heading, and in many cases obviating the necessity for counter-heads and thirls for ventilating purposes. The headings remain arched and unshaken, requiring little or no timber in their maintenance; and instances can be given of headings with under roofs, that otherwise would have been closely timbered, remaining intact as when first driven, without the help of timber. The smoothness of the heading and its freedom from timber and other obstructions also facilitate the ventilation.

In the almost innumerable trials that have taken place at the Nuneaton colliery of the patentees, the machine has never failed in any one case, to do the yard lineal, within the hour, and that often in coal which was very hard and dead, owing to the machine having been underworked. Numerous testimonials in the patentees book prove this fact.

A number of testimonials have been received by the patentees, proving that the machine possesses all the advantages claimed for it herein. Copies of same will be furnished on application, and also prices and full particulars of machines.

◆

Wolfram Mining in New Zealand.

Wolfram, or tungsten, belongs to a group of rare metals, and until a comparatively recent time was known only to the chemist, and its value was known only in the laboratory. With the invention of 100-ton guns the demand for tungsten soon made the previously obscure metal well known throughout the mining world. It was soon found that the steel tube lining the bore of these enormous guns could not resist the shock entailed by discharging many shots without becoming fractured. Experiment proved that the addition of a small quantity of tungsten to the fine steel employed in gun-making rendered the latter metal wonderfully elastic, so that the steel tube will expand under the tension of firing and contract again to its normal size a great many times before the quality of the metal is in any way impaired. The German gun factories absorb most of the tungsten found in the world, and from being a mere curiosity seen only in the laboratory of the chemist) this rare metal has acquired considerable value. Wolfram generally occurs in combination with iron in Europe, but it is also found in Scheelite, or tungstate of lime. It is in the latter form that it occurs in Otago. The metal itself is of a white colour, extremely brittle, and heavy, the specific gravity being 19·1, that of gold being 19·3. It will thus be seen that tungsten is a very heavy metal, being only very slightly lighter than gold.

◆

The total number of persons engaged in the gold and silver mines of the United States in 1889, above and below ground, was 57,650, which makes the average output per person employed, $1,722. The average earnings of the persons engaged were $749, which would give to the mining proprietors a return of $973 for each person employed, or a total of $65,823,450. The total value of the mines and works (mining plant, mills and reduction works) was $486,378,711.

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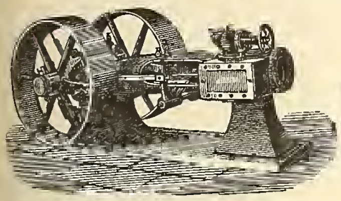

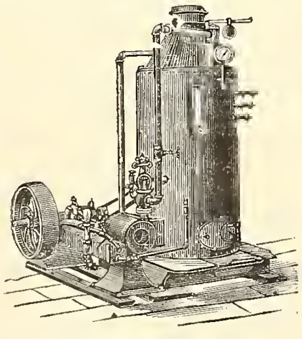

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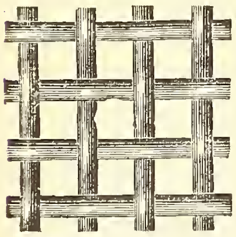

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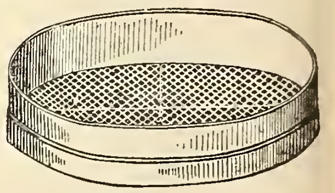

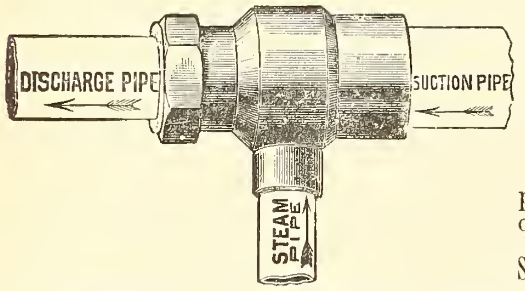

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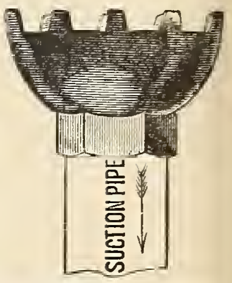

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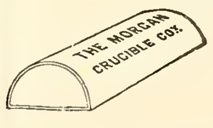
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Members of the force are supplied with free rations, a free kit on joining, and periodical issues during the term of service.

Applicants may be engaged at the Immigration office, Winnipeg, Manitoba; or at the Headquarters of the Force Regina N. W. T.

Money Orders.

Money Orders may be obtained at any Money Order Office in Canada, payable in the Dominion and Newfoundland; also in the United States, the United Kingdom, France, Germany, Austria, Hungary, Italy, Belgium, Switzerland, Portugal, Sweden, Norway, Denmark, the Netherlands, India, Japan, the Australian Colonies, and other Countries and British Colonies generally.

On Money Orders payable within Canada, the commission is as follows :

If not exceeding $4	2c.
Over $4, not exceeding $10	5c.
" 10, " " 20	10c.
" 20, " " 40	20c.
" 40, " " 60	30c.
" 60, " " 80	40c.
" 80, " " 100	50c.

On Money Orders payable abroad the commission is :

If not exceeding $10	10c.
Over $10, not exceeding $20	20c.
" 20 " " 30	30c.
" 30 " " 40	40c.
" 40 " " 50	50c.

For further information see Official Postal Guide.

Post Office Department, Ottawa.
1st November 1889.

FOR SALE.

The following first-class Phosphate lands in Templeton, P.Q :

		Lot	Con.	Acres
West ½	of Lot	8,	10th Con.,	100 acres.
South ½	"	16,	10th "	100 "
	"	11,	12th "	215 "
	"	12,	12th "	190 "
South pt.	"	13,	12th "	50 "
North "	"	21,	12th "	147 "
	"	11,	13th "	161 "
	"	12,	13th "	132 "
	"	17,	13th "	47 "
				1142 acres.

These lands are held in absolute fee simple under Crown Patents. In addition to phosphate they contain many other minerals, among which may be mentioned ASBESTOS, MICA and BARYTES. As will be observed, most of the lots are in fairly close proximity, and they adjoin, or are actually traversed by a good county road, affording easy transit to the East Templeton Railway Station and Wharves on the Ottawa River. After personal examination Sir William Dawson, LL.D., F.R.S., F.G.S., the eminent Geologist, reported regarding this property : "In my opinion it has been very judiciously selected both with reference to probable yield of phosphate and facility of transport."

Application may be made to

Mr. L. Marcellais,
Perkins' P.O.,
East Templeton, P.Q.

Or to **Mr. L. T. Paterson,**
Box 2002, Montreal

TORONTO MINING
ASSOCIATION.
[LIMITED].

§

This Association is established to form a centre of information on all matters pertaining to Mining, and a suitable place where specimens may be received and examined.

It is intended to collect in the rooms of the Association specimens of all merchantable Canadian Minerals, with particulars as to place of deposit, and other information which may be useful both from a scientific and merchantable point of view. With this object the Association has decided to open rooms in Toronto within the next few weeks, where information can be sent and obtained, of Mining Properties for sale, and the undersigned has been appointed Managing Director.

The Stock Books of the Association are now open, and mining men and parties having mining properties to dispose of in all parts of the Province are invited to become members of the Association and to send information regarding their properties.

A person can become a member by subscribing for one share of $10 and by paying an annual membership fee of $4.

Further particulars can be obtained by applying to the undersigned,

A. S. THOMPSON,
Managing Director,
Cor. Victoria & Lombard Sts., Toronto.

PROVINCE OF NEW BRUNSWICK.

Synopsis of "The General Mining Act," Chapter 16, 54th Victoria.

LEASES FOR MINES OF

GOLD, SILVER, COAL,
IRON, COPPER, LEAD,
TIN and PRECIOUS STONES.

GOLD AND SILVER.

Prospecting Licenses up to 100 areas, (each 150 feet by 250 feet), issued at 50 cts. an area up to 10 areas, and 25 cts. afterwards per area, good for one year. These Licenses can be renewed for second year, by payment of one half above amount.

Leases for 20 years to work and mine, on payment of $2 an area of 150 feet by 250 feet. Renewable annually at 50 cts. an area in advance.

Royalty on Gold and Silver, 2½ per cent.

MINES, OTHER THAN GOLD AND SILVER.

Licenses to Search, good for one year, $20 for 5 square miles. Lands applied for must not be more than 2½ miles long, and the tract so selected may be surveyed on the Surveyor General's order at expense of Licensee, if exact bounds cannot be established on maps in Crown Land Office. Renewals for second year may be made by consent of Surveyor General, on payment of $20.

Second Rights to Search can be given over same ground, subject to party holding first Rights, on payment of $20.

Leases.—On payment of $50 for one square mile, good for two years, and extended to three years by further payment of $25. The lands selected must be surveyed and returned to Crown Land Office. Leases are given for 20 years, and renewable to 80 years. The Surveyor General, if special circumstances warrant, may grant a Lease larger than one square mile, but not larger than two square miles.

ROYALTIES.

Coal, 10 cts. per ton of 2,240 lbs.
Copper, 4 cts. on every 1 per cent. in a ton of 2,352 lbs.
Lead, 2 cts. on every 1 per cent. in a ton of 2,240 lbs.
Iron, 5 cts. per ton of 2,240 lbs.

Tin and Precious Stones, 5 per cent. of value.

Applications can be fyled at the Crown Land Office each day from 9.30 a.m. to 4.30 p.m., except Saturday, when Office closes at 1 p.m.

L. J. TWEEDIE,
Surveyor General.

INTERCOLONIAL RAILWAY OF CANADA.

The direct route between the West and all points on the Lower St. Lawrence and Baie des Chaleur, Province of Quebec; also for New Brunswick, Nova Scotia, Prince Edward and Cape Breton Islands, Newfoundland and St. Pierre.

EXPRESS TRAINS leave Montreal and Halifax daily (Sunday excepted) and run through without change between these points in 30 hours.

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Passengers for Great Britain or the Continent by leaving Montreal on Friday morning will join Outward Mail Steamer at Halifax the same evening.

The attention of shippers is directed to the superior facilities offered by this route for the transport of flour and general merchandise intended for the Eastern Provinces and Newfoundland; also for shipments of grain and produce intended for the European market.

Tickets may be obtained and all information about the route, also Freight and Passenger rates, on application to

G. W. ROBINSON,
Eastern Freight and Passenger Agent,
136½ St. James Street, MONTREAL.

E. KING,
Ticket Agent,
27 Sparks Street, OTTAWA.

Railway Offices, Moncton, N.B., 14th November, 1889.

D. POTTINGER, Chief Superintendent.

MAP
—OF THE—
Phosphate Region
—OF—
OTTAWA COUNTY, QUEBEC.

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On sale only at the Offices
OF THE
CANADIAN MINING REVIEW,
OTTAWA.

MINING REGULATIONS

TO GOVERN THE DISPOSAL OF DOMINION LANDS CONTAINING MINERALS, OTHER THAN COAL, 1890.

THESE REGULATIONS shall be applicable to all Dominion Lands containing gold, silver cinnabar, lead, tin, copper, petroleum, iron or other mineral deposits of economic value, with the exception of coal.

Any person may explore vacant Dominion Lands not appropriated or reserved by Government for other purposes, and may search therein either by surface or subterranean prospecting for mineral deposits, with a view to obtaining under the Regulations a mining location for the same but no mining location or mining claim shall be granted until the discovery of the vein, lode or deposit of mineral or metal within the limits of the location or claim.

QUARTZ MINING.

A location for mining, except for iron or petroleum, on veins, lodes or ledges of quartz or other rock in place, shall not exceed 1,500 ft. in length and 500 ft. in breadth. Its surface boundary shall be four straight lines, the opposite sides of which shall be parallel, except where prior locations would prevent, in which case it may be of such a shape as may be approved of by the Superintendent of Mining.

Any person having discovered a mineral deposit may obtain a mining location therefor, in the manner set forth in the Regulations which provides for the character of the survey and the marks necessary to designate the location on the ground.

When the location has been marked conformably to the requirements of the Regulations, the claimant shall within sixty days thereafter, file with the local agent in the Dominion Land Office for the district in which the location is situated, a declaration or oath setting forth the circumstances of his discovery, and describing, as nearly as may be, the locality and dimensions of the claim marked out by him as aforesaid; and shall, along with such declaration, pay to the said agent an entry fee of FIVE DOLLARS. The agent's receipt for such fee will be the the claimant's authority to enter into possession of the location applied for.

At any time before the expiration of FIVE years from the date of his obtaining the agent's receipt it shall be open to the claimant to purchase the location on filing with the local agent proof that he has expended not less than FIVE HUNDRED DOLLARS in actual mining operations on the same; but the claimant is required, before the expiration of each of the five years, to prove that he has performed not less than ONE HUNDRED DOLLARS' worth of labour during the year in the actual development of his claim, and at the same time obtain a renewal of his location receipt, for which he is required to pay a fee of FIVE DOLLARS.

The price to be paid for a mining location shall be at the rate of FIVE DOLLARS PER ACRE, cash, the sum of FIFTY DOLLARS extra for the survey of the same.

No more than one mining location shall be granted to any individual claimant upon the same lode or vein.

IRON AND PETROLEUM.

The Minister of the Interior may grant a location for the mining of iron or petroleum, not exceeding 160 acres in area which shall be bounded by north and south and east and west lines astronomically, and its breadth shall equal it in length. Provided that should any person making an application purporting to be for the purpose of mining iron or petroleum thus obtain, whether in good faith or fraudulently, possession of a valuable mineral deposit other than iron or petroleum, his right in such deposit shall be restricted to the area prescribed by the Regulations for other minerals, and the rest of the location shall revert to the Crown for such disposition as the Minister may direct.

The regulations also provide for the manner in which stone quarries may be acquired.

PLACER MINING.

The Regulations laid down in respect to quartz mining shall be applicable to placer mining as far as they relate to entries, entry fees, assignments, marking of localities, agents' receipts, and generally where they can be applied.

The nature and size of placer mining claims are provided for in the Regulations, including bar, dry, bench, creek or hill diggings, and the RIGHTS AND DUTIES OF MINERS are fully set forth.

The Regulations apply also to

BED-ROCK FLUMES, DRAINAGE OF MINES AND DITCHES.

The GENERAL PROVISIONS of the Regulations include the interpretation of expressions used therein; how disputes shall be heard and adjudicated upon; under what circumstances miners shall be entitled to absent themselves from their locations or diggings, etc., etc.

THE SCHEDULE OF MINING REGULATIONS

Contains the *forms* to be observed in the drawing up of all documents such as:—"Application and affidavit of discoverer of quartz mine." "Receipt for fee paid by applicant for mining location." "Receipt for fee on extension of time for purchase of a mining location." "Patent of a mining location." "Certificate of the assignment of a mining location." "Application for grant for placer mining and affidavit of applicant." "Grant for placer mining." "Certificate of the assignment of a placer mining claim." "Grant to a bed-rock flume company." "Grant for drainage." "Grant of right to divert water and construct ditches."

Since the publication, in 1884, of the Mining Regulations to govern the disposal of Dominion Mineral Lands the same have been carefully and thoroughly revised with a view to ensure ample protection to the public interests, and at the same time to encourage the prospector and miner in order that the mineral resources may be made valuable by development.

COPIES OF THE REGULATIONS MAY BE OBTAINED UPON APPLICATION TO THE DEPARTMENT OF THE INTERIOR.

A. M. BURGESS,
Deputy Minister of the Interior.

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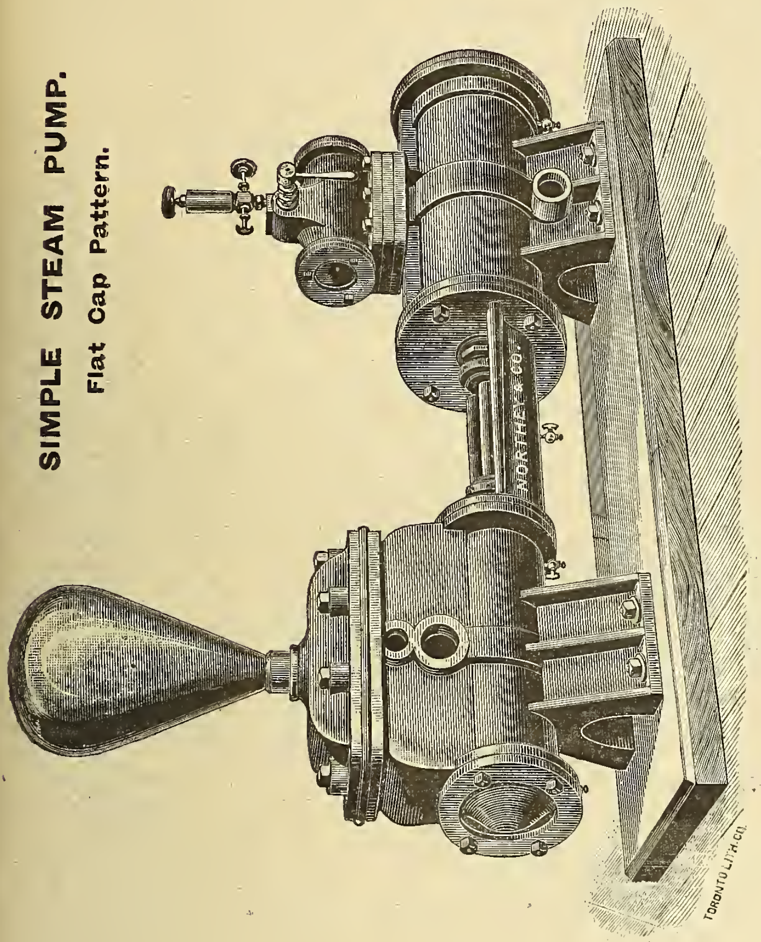
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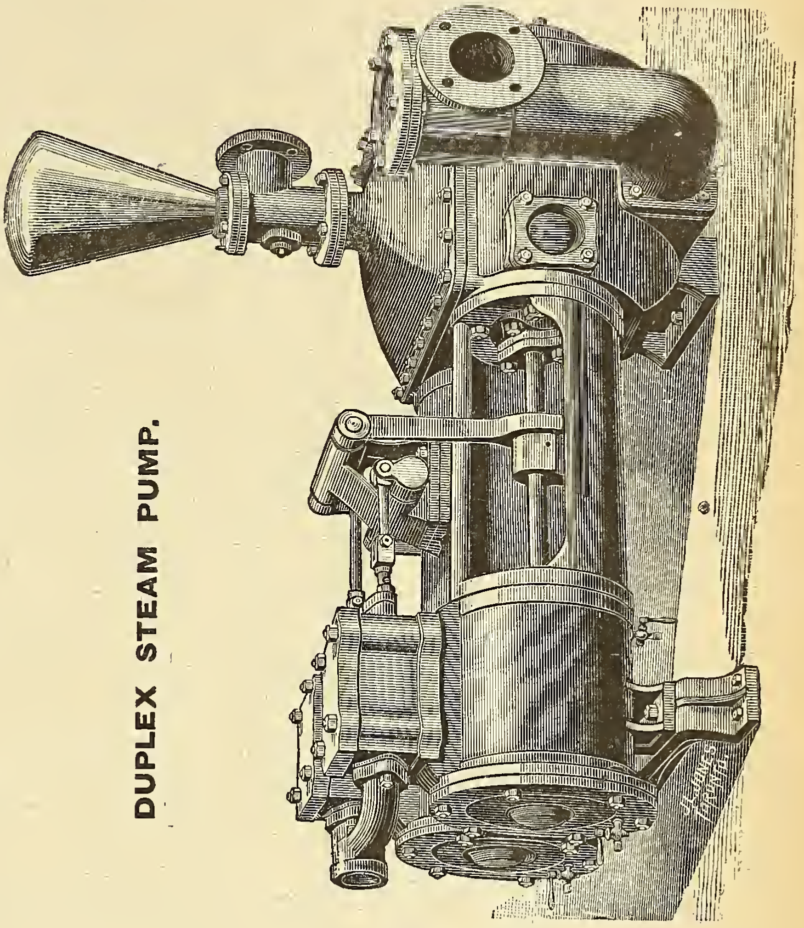

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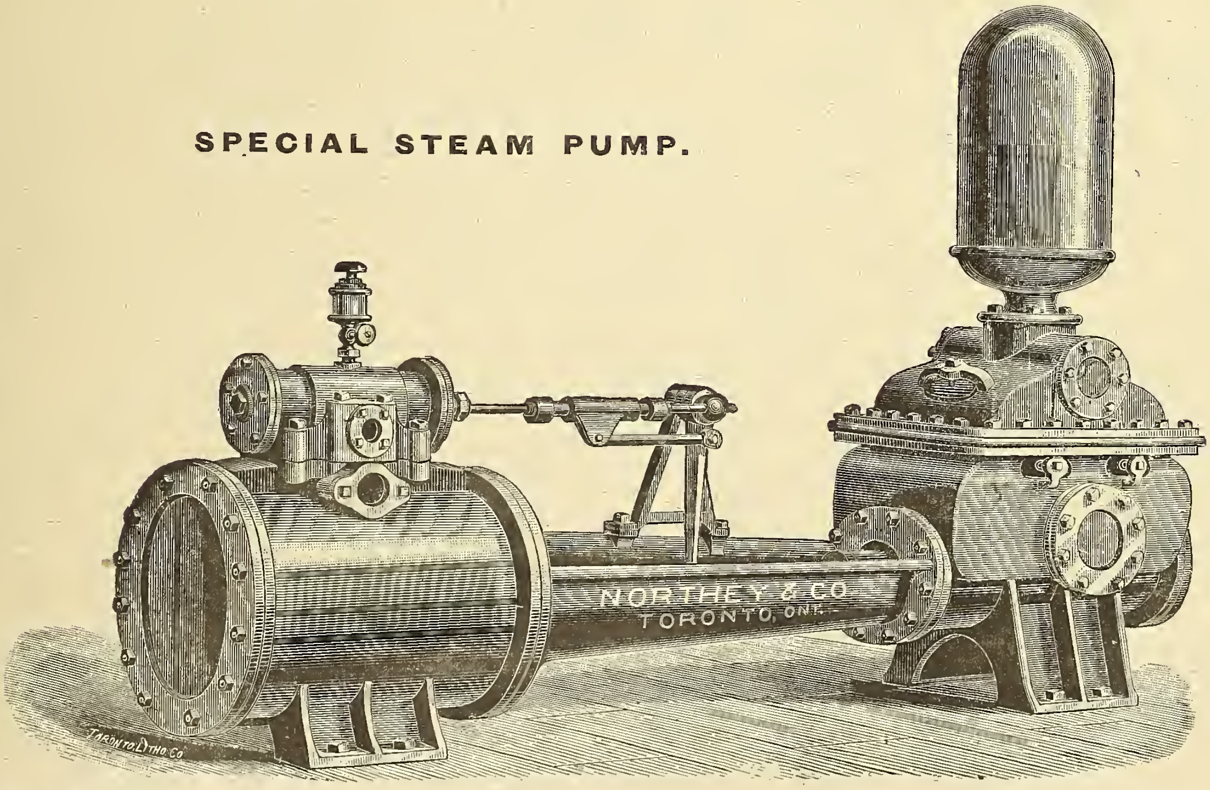
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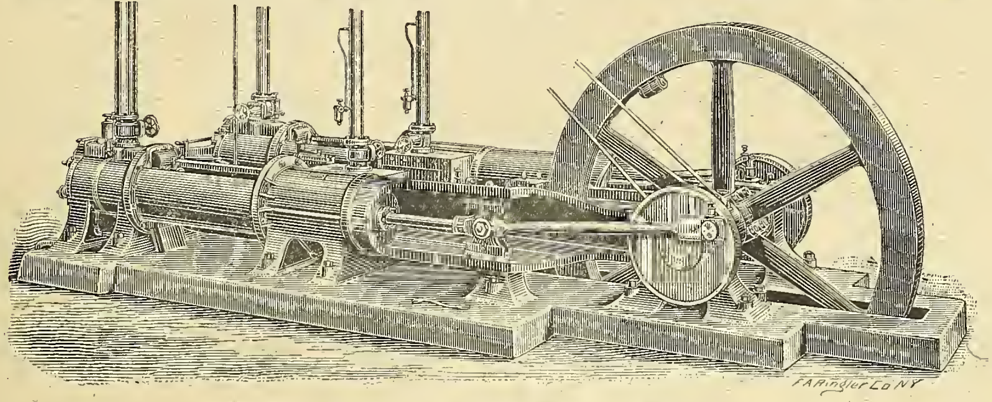

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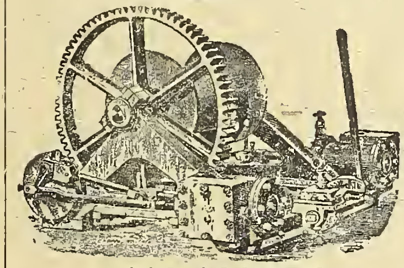

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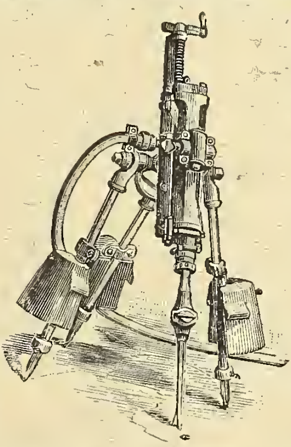

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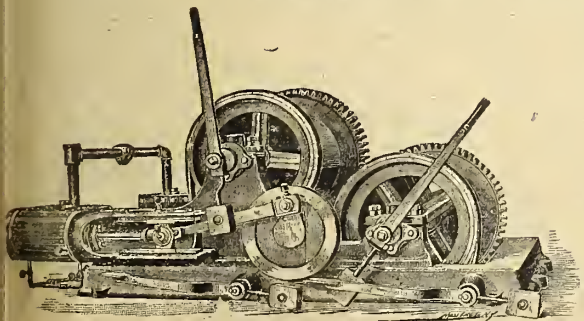

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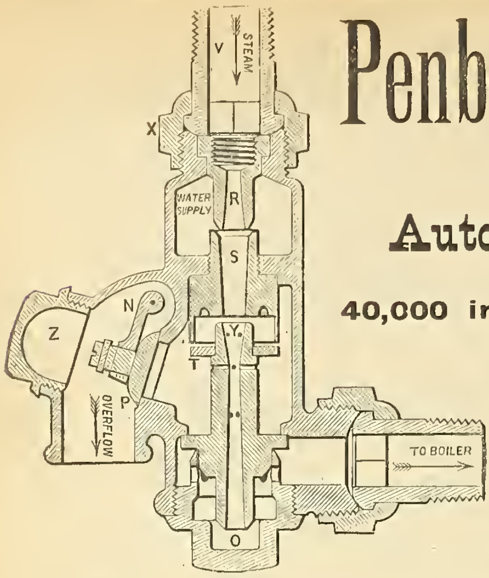

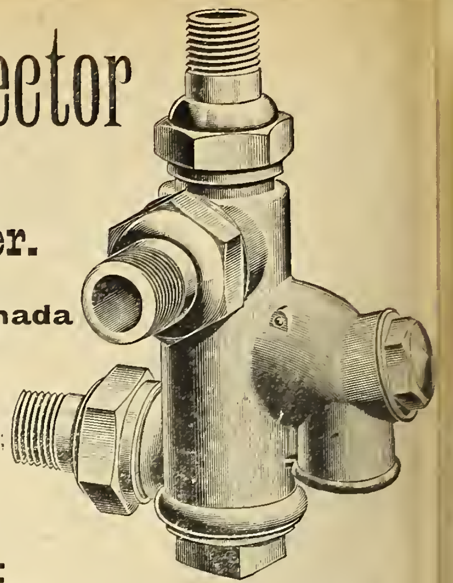

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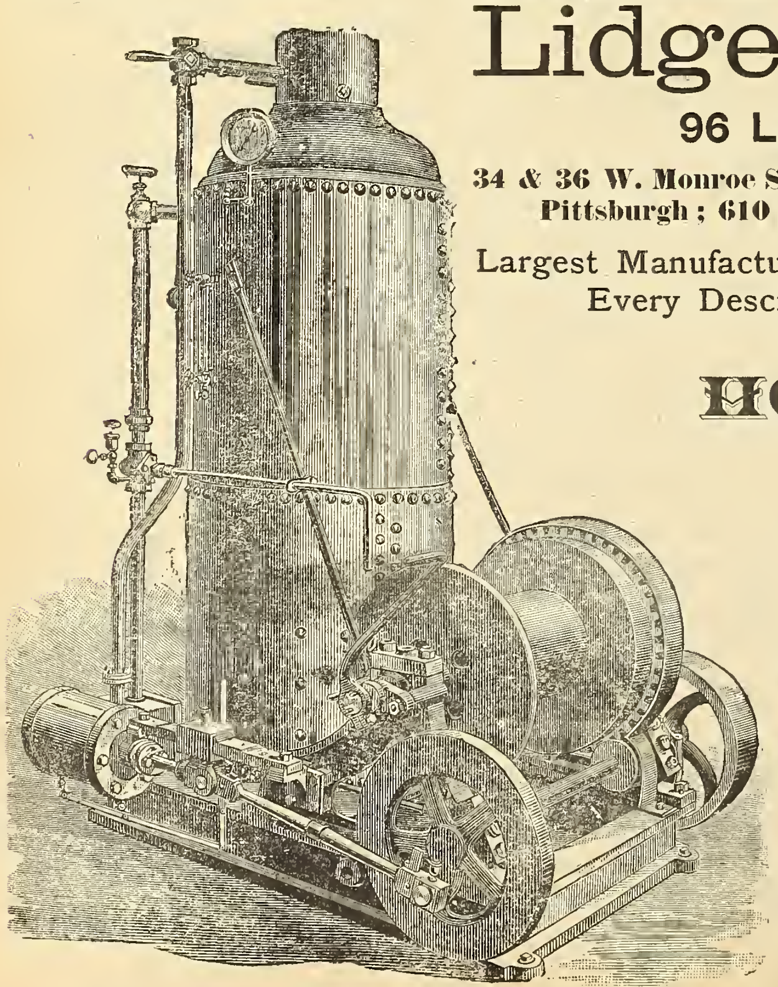

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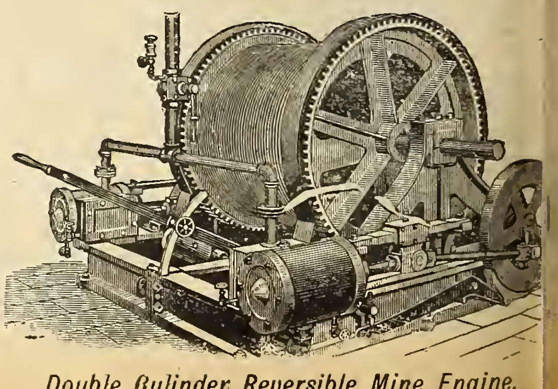

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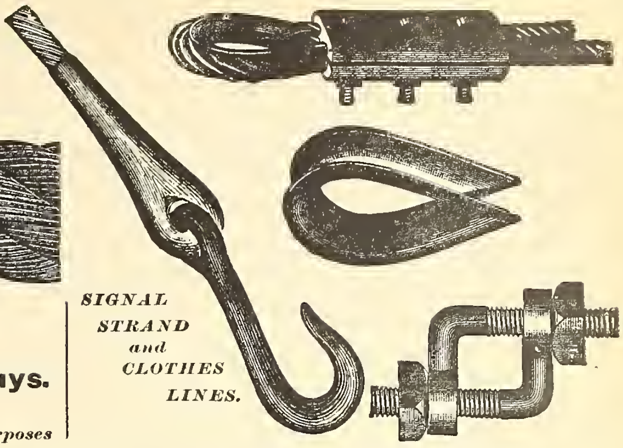

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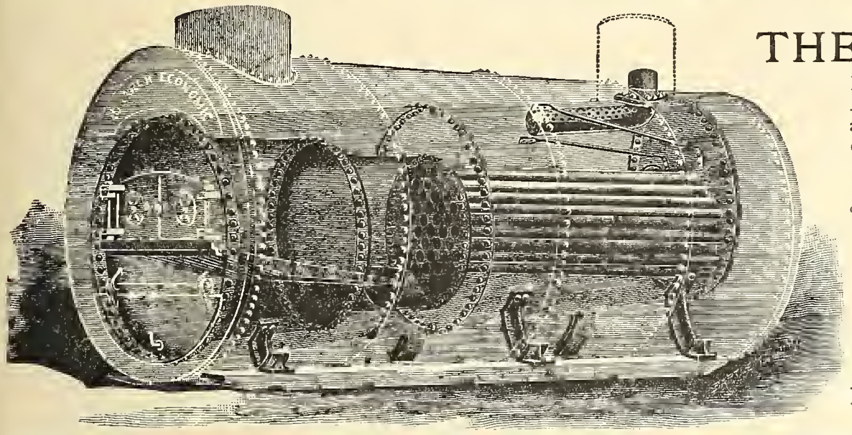

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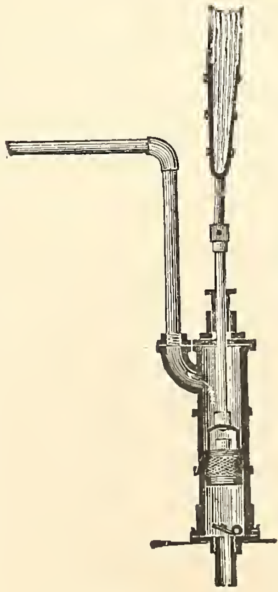

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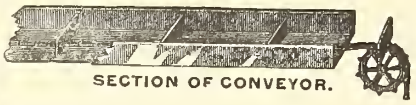

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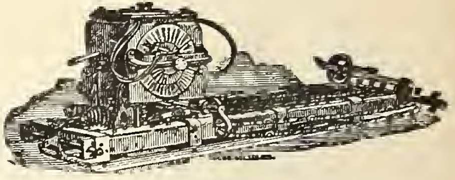

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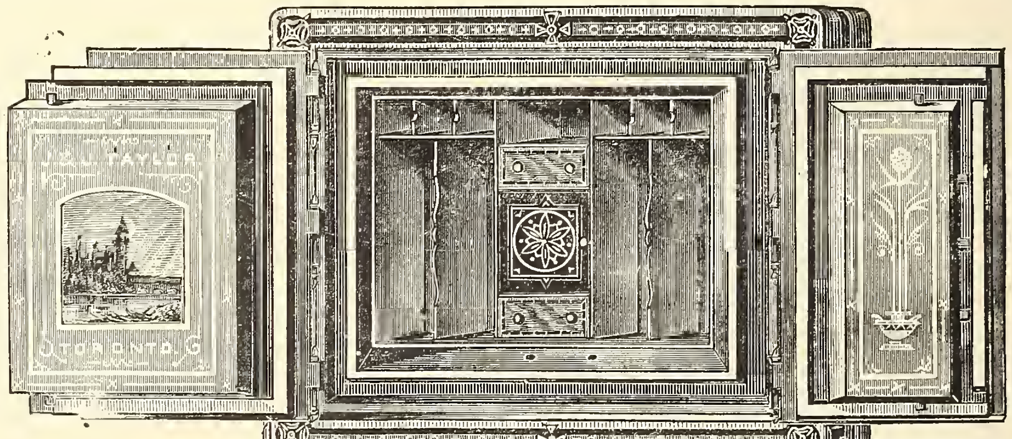

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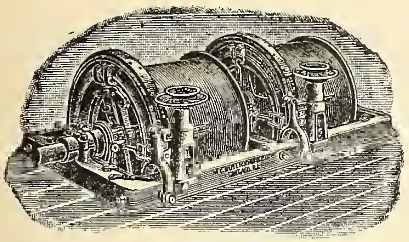

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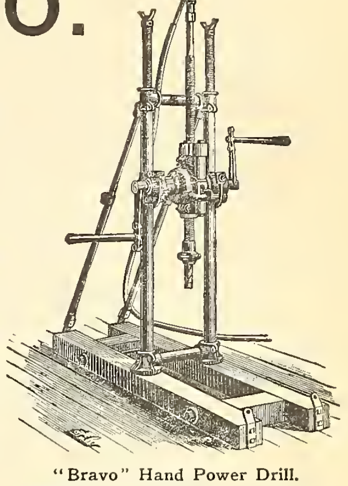

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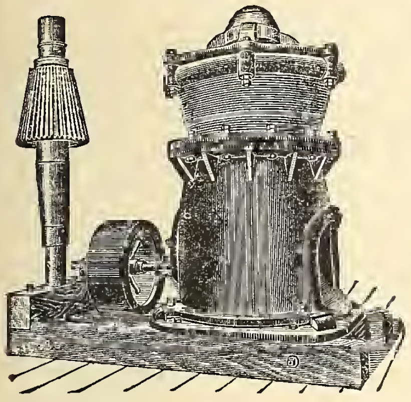

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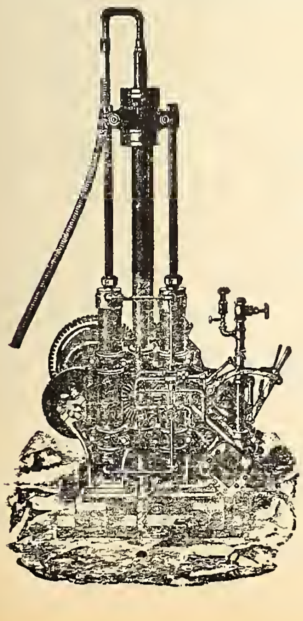

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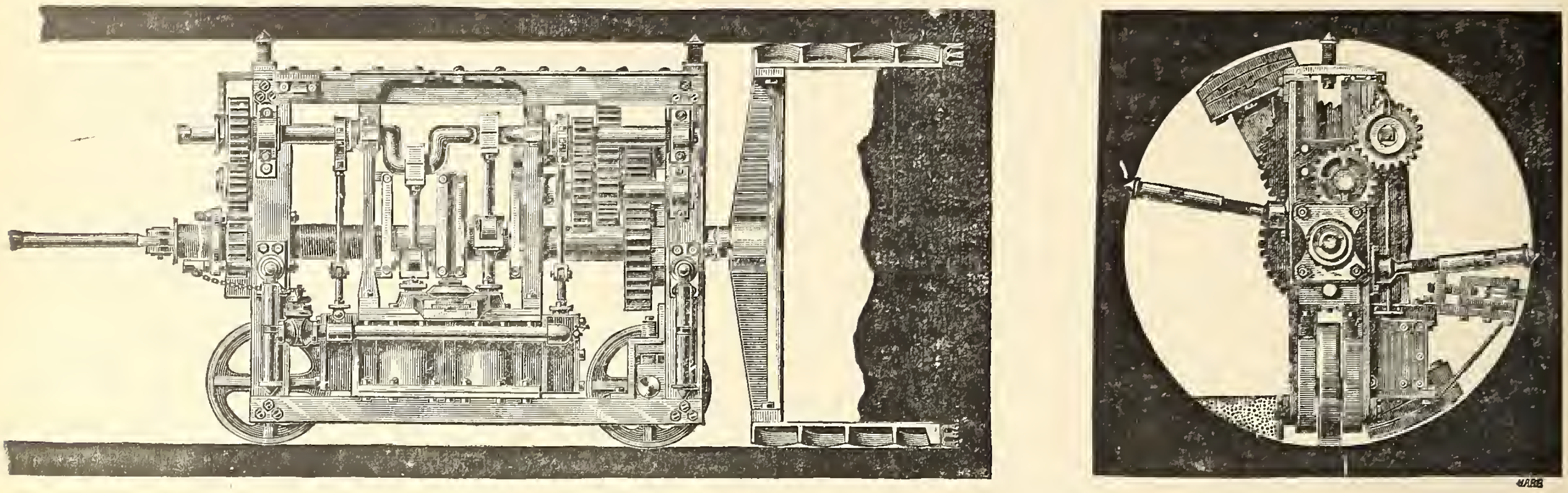

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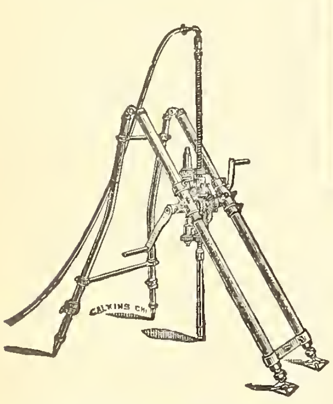

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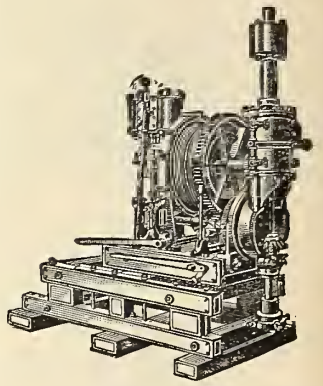

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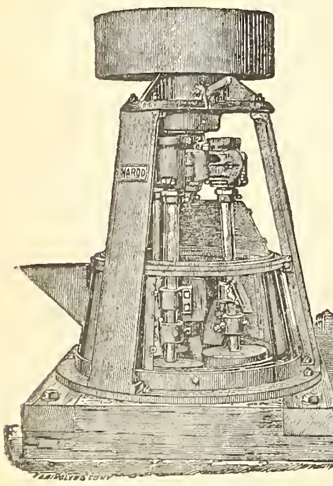

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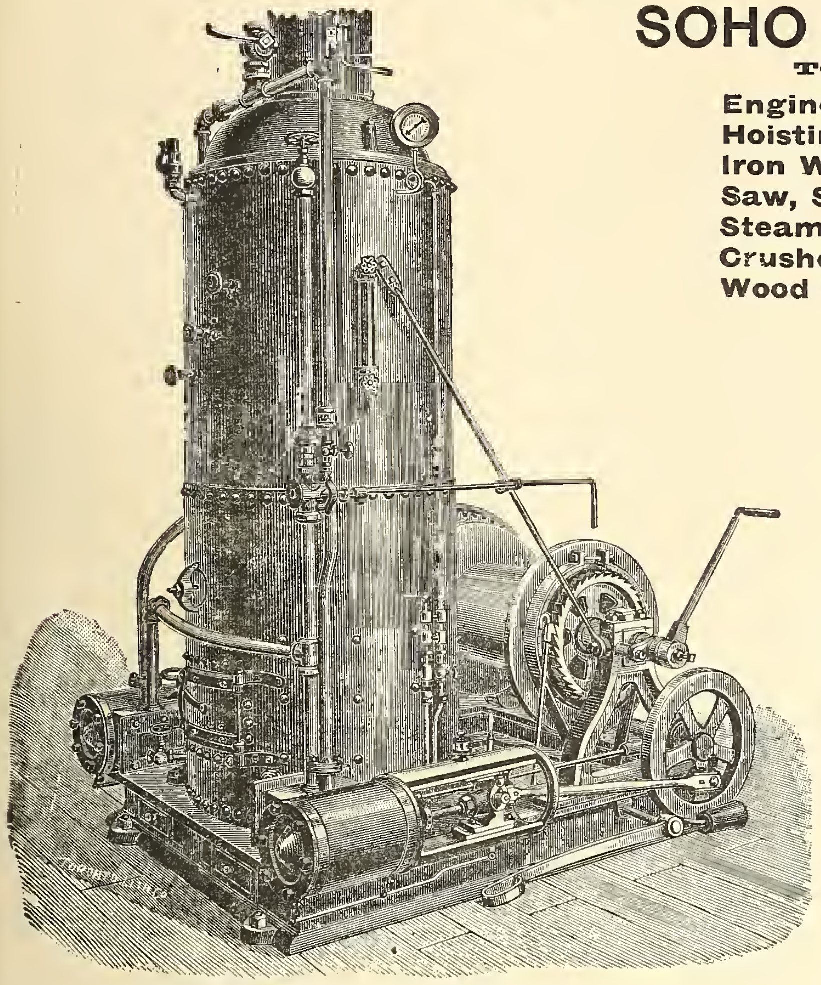

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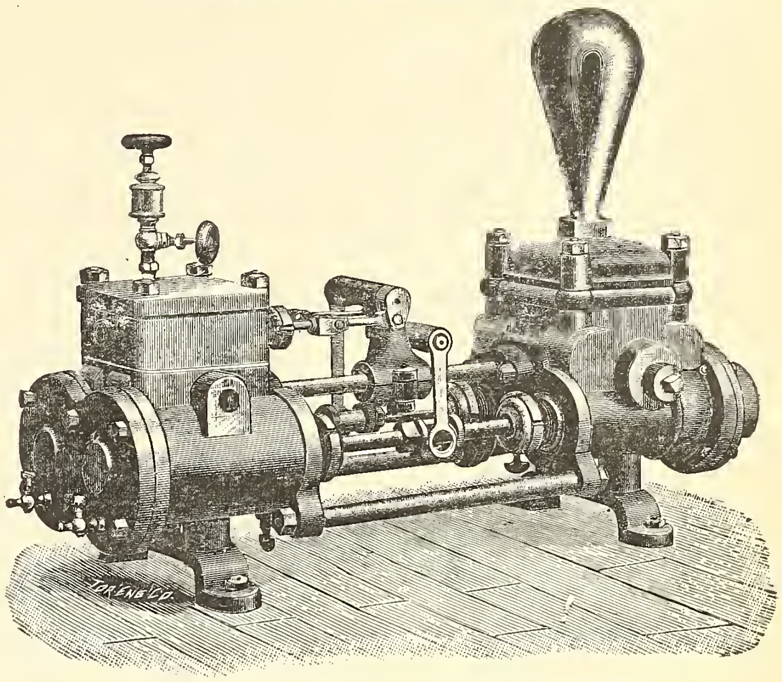

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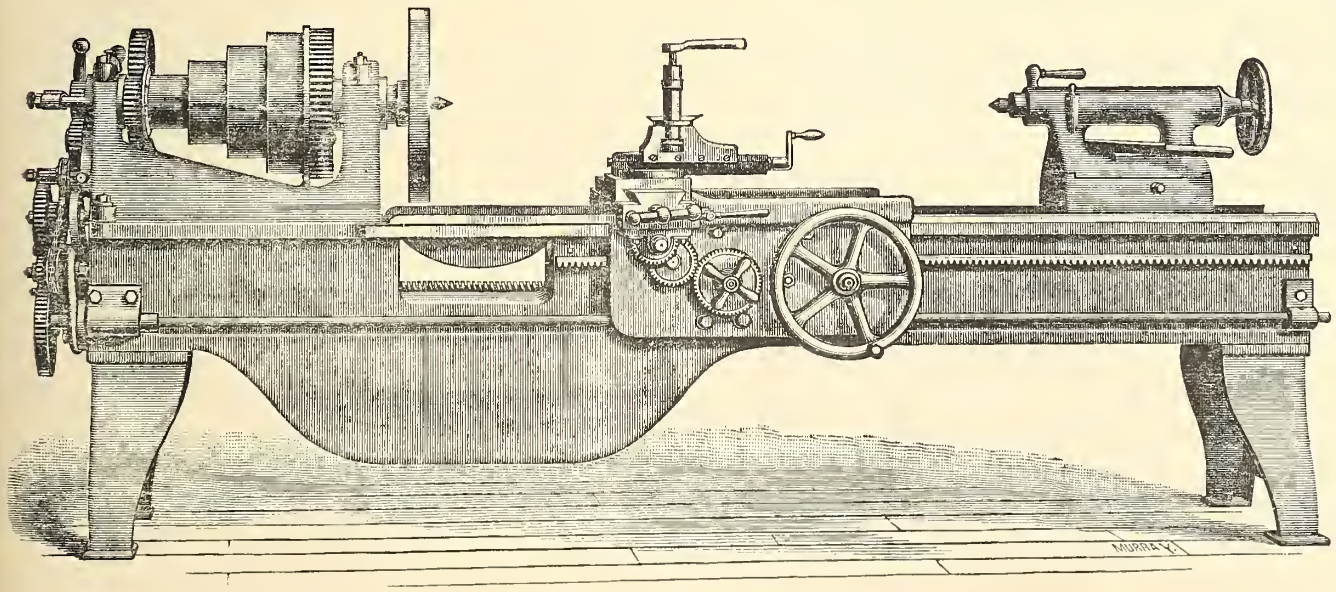

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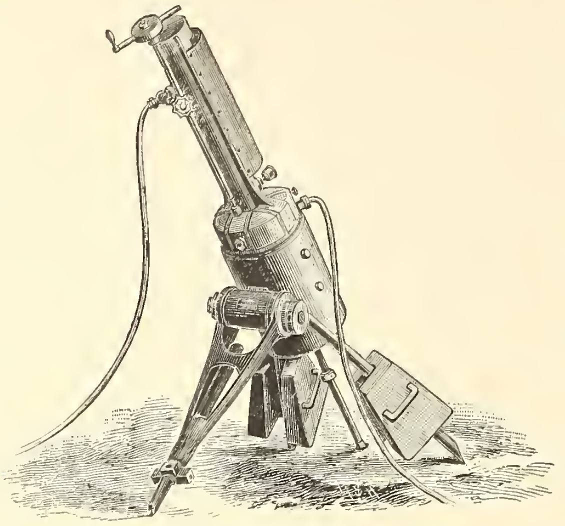

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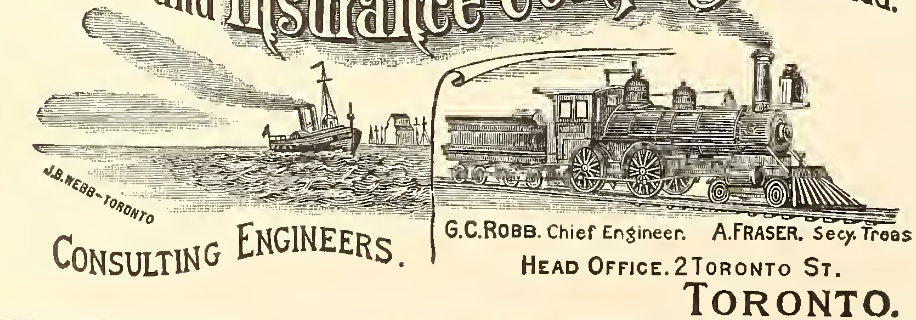

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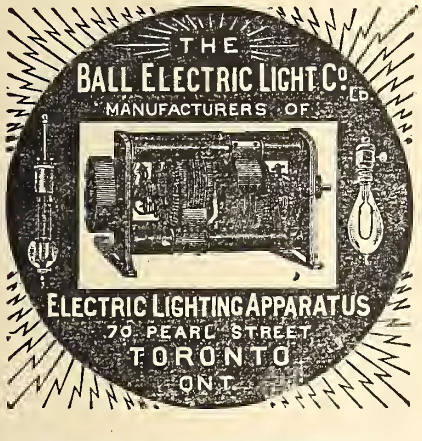

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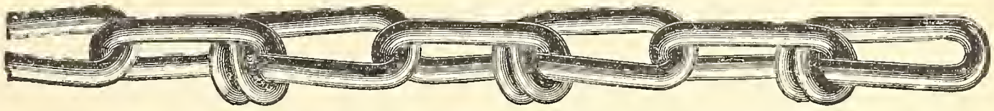

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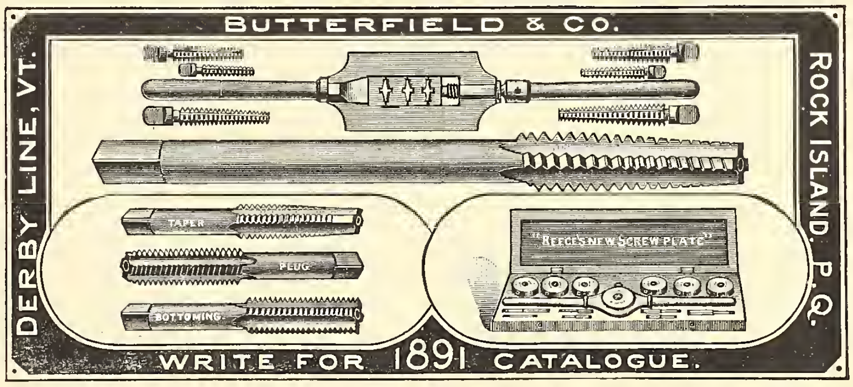

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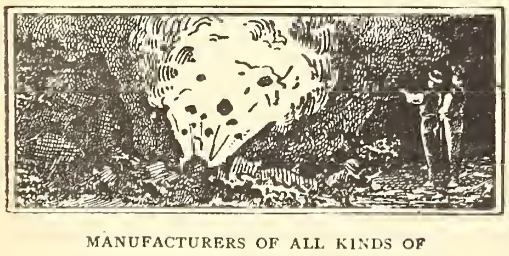

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Ontario Mining Laws.

The following is a summary of the chief provisions of the amendments to the Mining Laws of Ontario, passed during the Session of 1891:

1. In Algoma, Thunder Bay, Rainy River and that part of Nipissing north of Lake Nipissing and the French and Mattawa Rivers, the price per acre of mining lands sold after the 4th day of May, 1891, is $4.50 in a surveyed township, and $4 in an unsurveyed territory, if within 12 miles of a railway, and if beyond that limit $3.50 in surveyed and $3 in unsurveyed territory. Elsewhere the price is $3 in a surveyed township any part of which lies within 12 miles of a railway, and $2 if at a greater distance.

2. Instead of by grant in fee simple, mining land may be obtained under a ten years' lease at a per acre rental, unless otherwise fixed by regulation, of $1 for the first year and 25 cents yearly thereafter if north of Lake Nipissing and the French and Mattawa Rivers, or of 60 cents for the first year and 15 cents yearly thereafter, if situated elsewhere, with right of renewal at the expiration for an additional ten years at the same rentals, and with a right of renewal thereafter every twenty years, subject to payment of the yearly rent charge in advance and to such conditions as may be provided by regulation. But the lessee may at any time purchase the land so held, in which case the first year's rent shall be treated as part of the purchase money.

3. The owner or lessee of mining land sold or leased by the Crown after the 4th day of May, 1891, is required during the first seven years to expend in actual mining operations $4 per acre if the location exceeds 160 acres, and $5 per acre if it is 160 acres or less.

4. After the 4th day of May, 1891, all ores or minerals of silver, nickel, or nickel and copper, taken from lands sold or leased by the Crown, are subject to a royalty of 3 per cent., and all other ores or minerals to such royalties as shall from time to time be fixed by Order-in-Council, not exceeding in the case of iron 2 per cent., and as to any other ores or minerals not exceeding 3 per cent.; and such royalties shall be calculated upon the value of the ores at the pit's mouth. But royalties shall not be imposed or collected upon any ores until after seven years from date of the patent or lease, except as to mines known to be rich in nickel, and as to these not until after four years.

5. Hereafter in all lands sold under the Public Lands Act, or for agricultural purposes, all minerals and mining rights are reserved to the Crown, unless otherwise provided in the patent or grant.

6. In the case of mining lands for which bona fide application was made in writing to the Department prior to the 24th April, 1891, grants may be made where the application is received within three months from the 4th day of May, 1891, and otherwise at the price and upon the conditions heretofore applicable in accordance with the terms of section 1, sub-section 5, of the Act of 1891.

ARCHIBALD BLUE,
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OFFICE OF THE BUREAU OF MINES,
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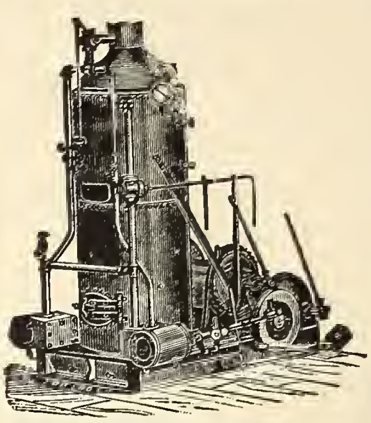

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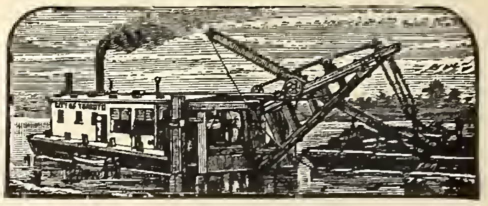

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CONDUCTED BY - - - - - - - B. T. A. BELL.

OFFICES:
Victoria Chambers, 140 Wellington Street,
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Vol. X. OCTOBER, 1891. No. 10.

Notes on Some Alloys.

The relations of aluminum with manganese are important. Their combining equivalents are as 1 : 2. Their sesquioxides are isomorphous; that of manganese forms, with potash, sulphate or ammonia, octahedral crystals having the constitution of common alum. In some deposits of earthy hematite the manganese content is remarkably variable, ranging from 2 to 10 per cent. and attended with some variation in the percentage of iron. The genesis of this material has another interesting fact to account for in the immense covering of manganese nodules spread over the ocean floor, according to the revelations of the submarine depths given to us by the "Challenger" expedition. Diaspore in the chrysoberyl series, of the composition H_2O, Al_2O_3, may be put alongside of manganite in the same series, of the composition H_2O, Mn_2O_3. The efficiency of manganese in the blast furnace and Bessemer converter is in part due to its specific heat 0·1217, while that of iron is 0·1138. Aluminum in the foundry cupola behaves differently from manganese towards combined carbon, setting free a portion of it when the metal begins to cool, to pass into the graphitic form. Manganese is said to enable cast metal to hold more carbon in solution, and thus favors chill and extreme hardness. This hardening property of manganese may be contrasted with the toughening quality of aluminum. The latter seems to be due to its effect upon the grain, producing fineness of texture. Manganese is claimed to harden steel to withstand abrasion, as for the grinding parts of rock mills, to an extraordinary degree; and special parts of machines are now supplied carrying different percentages of manganese alloyed with steel.

Aluminum has recently entered into two new partnerships for definite purposes. As an alloy with the composition known as aluminum bronze, it has so greatly improved the old firm as to raise its credit as high as German silver. It is claimed to be less corrodible than even nickel-silver. Its composition is, manganese 18%, aluminum 1.20%, silver 5%, zinc 13%, copper 67.5%. The other alloy has been but recently announced. It is a combination of aluminum and that strange metal, titanium, and of which nothing is as yet made known, but just such a character as might have been expected—that it is extremely hard while retaining some of that character for lightness which aluminum has.

Other alloys have lately been pointed to by Prof. Roberts-Austen, which should have some consideration from Canadian experimenters. Molybdenum he says, should be produced as cheaply as tin, and as it exists in the form of molybdenite in considerable quantity in this country, it will no doubt repay the investigation of its alloying combinations. The mineral is said to be extensively disseminated among rocks in the vicinity of Jones' Falls on the Rideau Canal, and in other sections of the Province of Ontario. Zirconium attracts attention as a metalloid which (in so small a combination as one-fifth of one per cent.) imparts great strength to gold. Zircon crystals have been found in considerable quantity in the township of Sebastopol, County of Renfrew. The subject of these and other alloys demands attention in our mining schools, for the purpose of leading the minds of students to the unexplored fields where research and ingenuity may reap rich rewards by giving to industrial processes new materials for further attainments in the arts.

The newly announced alloy of aluminum and titanium discovered by Prof. J. W. Langley, is of little greater specific gravity than pure aluminum, the amount of titanium used being very small. The alloy has a resilience and spring which will make it of use for many purposes, and it is claimed that when rolled or otherwise worked it shows a greater degree of hardness than in the cast form.

EN PASSANT.

Our next issue will contain a very full and graphic description of the "Mineral Resources of New Brunswick," from the pen of Prof. L. W. Bailey, Fredericton, a valued worker on the staff of the Geological Survey of Canada, who has given special attention to the examination and investigation of this interesting field.

From the Geological and Natural History Survey of Canada we have to acknowledge the Annual Report for 1888-9. It consists of ten separate reports, with maps and illustrations, relating to the geology, mineralogy and natural history of various sections of the Dominion. The present volume includes: "An Exploration in the Yukon and Mackenzie Basins," by R. G. McConnell; "An Exploration of the Glacial Lake Agassiz in Manitoba," by Warren Upham; "On the Mineral Resources of the Province of Quebec," by Dr. R. W. Ells; "The Surface Geology of Southern New Brunswick," by R. Chalmers; "Chemical Contributions from the Laboratory of the Survey," by G. C. Hoffman; "Mining and Mineral Statistics," by E. D. Ingall and H. P. Brummell; "Annotated List of the Minerals occuring in Canada," by G. C. Hoffman; and a very valuable report "On a Portion of the West Kootenai District, B.C.," which we reproduce elsewhere. The whole volume may be obtained for two dollars, while any of the reports enumerated may be had for from twenty to thirty cents each. We heartily commend the new volume to the attention of all our readers.

In the course of a fortnight we are promised a work of great interest on the subject of "The Phosphates of the World," from the pen of Dr. Frances Wyatt, New York. We hope to be able to fully review this comprehensive and valuable treatise in our next issue.

Wilder's patent for an aluminum alloy, composed of zinc, tin and aluminum, has been acquired by a company operating on an extensive scale at Hampton, Ia. Being free from iron this alloy is incorrodible, and it is said that it will cost less than first quality tin-plate, will be supplied in larger sizes, and will thus cost less for soldering.

From a recent report of the United States Consul in New Caledonia, it appears that in an area of 2,000,000 square kilomètres the nickel-producing area is about 800,000; that of this 80,000 kilomètres have been granted to mining companies and that about 20,000 kilomètres are being actually worked. The composition of the nickel ore is hydrated silicate of nickel and magnesia, without any trace of arsenic. It contains from 8 to 10 per cent. of metal, some samples containing as much as 16 per cent. The value of the poorer ore at ports of shipment is now £4 per ton. The mines are said to be inexhaustible. The exports of ore last year from New Caledonia were: Nickel ore, 5,000 tons; chromate of iron, 1,500; cobalt, 700; gold quartz, 210; and small quantities of nickel, silver, lead and copper. These exports, however, will increase, as orders have been received for large quantities, the Creusot works alone ordering 100,000 tons of nickel ore. Foundries and furnaces are being erected near Noumea for the treatment of the ore.

A recent United States Census Bulletin on graphite gives the production of this mineral in the United States, for the year 1889, at 7,000 short tons, of which one half was got in New York State. The crude ore is valued about $12 a ton and the cost of mining in New York stated at $5.30 and in Pennsylvania at $6 a ton. The yearly production of refined graphite is an apparently steady average of 400,000 lbs. valued at 8¼ cents a pound. The importation over five years was little in excess of the home production, being 7,240 long tons, yearly average, valued at $45 a ton. Besides the well known uses for pencils, crucibles and stove polish, a large use of graphite is now made for lubricating the bearings of heavy machinery. Grooved bushings in the boxes are filled with a composition of 75 per cent. graphite. As a substitute for red lead in packing joints it has the advantage that it does not harden and makes a tight joint that opens easily under the pipe tongs. It also makes a durable paint for smoke-stacks, boilers, tin roofs and other metal surfaces. It is probable that the value of the graphitic schist mined for the Dixon Crucible Company in New York State and the cost of mining are correctly given, but it may be doubted if the quantity of refined graphite manufactured in the United States is correctly reported.

The first volume of the *Journal* of the Iron and Steel Institute for the present year is just to hand, and as usual contains a vast amount of information of value to the iron and steel trades and their affiliated industries, compiled by its energetic editor, Mr. Jeans. Besides the Presidential address of Sir Frederick Abel, the *Journal* contains papers on "Tests for Steel used in the Manufacture of Artillery," by W. Anderson, D. C. L.; "Automatic Methods of Observation in the use of the Le Chatelier Pyrometer," by Prof. Roberts-Austen, C.B.; "Notes on the Micro-Structure of Steel," by F. Osmond; "On the changes in Iron produced by Thermal Treatment, II," by E. J. Ball, Ph. D.; "Economical Puddling and Puddling Guides," by Thos. Turner, A.R.S.M.; "A Graphic Method for Calculating Blast Furnace Charges or Burdens," by H. C. Jenkins, Assoc. M. Inst., C.E.; and "Recent Progress in the manufacture of War Material in the United States," by W. H. Jaques. The Council announces that a special number will be issued at an early date, specially describing and recording the "Proceedings and Excursions held in the United States and Canada this time last year. This valuable work will take the form of a memorial volume, embracing not only accounts of the numerous mines, works and other places of interest visited in this country, but also special descriptive and critical papers by experts, the whole constituting an interesting souvenir of a very memorable occasion.

The paper on "Magnetic Concentrates in the Blast Furnace," of which a synopsis is elsewhere given, was the subject of some discussion at the Glen Summit meeting of the American Institute of Mining Engineers. Dr. Raymond said magnetic concentrates could in general only be profitably prepared from waste dumps. He was willing to stand by the statement he had made, that there is no American mine where it will pay to mine and concentrate lean magnetic ore. He would admit he was wrong when the Croton mines have been run long enough to furnish regular working figures, and not the results of a few months only. The low cost of mining at Croton was exceptional and by no means represented American mines in general. In the paper read no account was taken of royalty on ore or increase in future mining expenses. The small profit made proves how hard the whole thing is going to be unless everything is in its favor, and magnetic concentration will probably result profitably at only a few mines. He distinguished between the use of fine ore and dust concentrates in the furnace. If such as the 60 per cent. stuff from Edison's plant at Ogden were used, there would be great loss in flue dust. The chief use of concentrates will be in the form of briquettes for the open hearth furnace. Mr. Moffatt said the Lackawanna company had used 8,000 tons of concentrates from 60 mesh to ¾ mesh fineness; they commonly formed from one-twelfth to one-third of the furnace charge, and even fifty per cent. had been used. The flue dust had been of small amount, but it was found advantageous to moisten the ore when very fine. The experience of Mr. Langdon in the use of concentrates, at Witherbles, Sherman & Co.'s furnaces, Port Henry, N.Y., was given in a paper read at the meeting, the summary of which is, that with proper management there is no difficulty in using in the blast furnace at least 80 per cent of high grade magnetic concentrate, and there is an economy of fuel with the use of a large percentage of concentrate beyond what may be due to an increase of iron content in the mixture, and this economy may be attributed to the comminution of the ore.

It is said that when the formation of a Mining Bureau, as an adjunct to the Geological Survey, with the function of conducting an experimental plant for purposes of instruction, was mooted to the late Sir John Macdonald, he replied at once, "Your plan is an educational scheme, and would bring us in conflict with the provincial governments." This is mentioned merely to show that the great architect of Confederation was a typical Canadian politician, quick to see the political, rather than the practical side of a proposition. By its Experimental Farm at Ottawa, and its College of Military Science and Engineering at Kingston, the Dominion Government is in the educational field for the benefit of farmers and soldiers. If the Geological Survey cannot be made of educational value to the mining interests of the country its chief end is unfulfilled. Much might be said for the utilization of the great water power at Ottawa for an electric furnace, for electrolytic operations on low grade ores, for driving a model concentration mill, and for hydraulic appliances in a small complete furnace plant for all metallurgical processess. But though supported by the highest scientific testimony in the world as to the great value of such an institution, it may be doubted if a proposal for it would be seriously entertained.

The excellence of the electrical outfit of the Science Department of McGill University, received merited commendation during the late electrical exhibition at Montreal. It is satisfactory to know that this branch of engineering science can be fully taught at McGill, and that the equipment for demonstration and experiment is second to that of no educational institution in the world.

The presidential address of Prof. Roberts-Austen to the chemical section of the British Science Association at the late meeting at Cardiff, touched upon a wide range of subjects interesting to metallurgists, the characteristic note struck being an appeal for further research into the causes of phenomena brought near to us by the wonderful discoveries of Bessemer, Siemens, Gilchrist, Osmond and others. He concluded by "earnestly pleading for the more extended teaching of metallurgy throughout the country and for better laboratories arranged on the model of engineering laboratories in which the teaching is conducted with the aid of complete though small 'plant.' The necessity for affording public instruction in mining and metallurgy with a view to the full development of the mineral wealth of a nation is well known. The issues at stake are so vast that in this country, it was considered desirable to provide a centre of instruction in which the teaching of mining and metallurgy should not be left to private enterprise or even entrusted to a corporation, but should be under the direct control of the Government. With this end in view, the Royal School of Mines was founded in 1851, and has supplied a body of well trained men who have done excellent service for the country and her colonies."

Andrew Lang's saying, that "where as a matter of science we know nothing we can only utter the message of our temperature," quoted by Professor Roberts-Austen at the close of his address, may be used to account for the apathy of the governing bodies in the Canadian confederation towards efforts for the scientific investigation of our mineral resources and the development of metallurgical processes in the country. If with all her vast attainment in industrial arts and science, Great Britain requires for her students in metallurgy, laboratories in which teaching is conducted with the aid of a complete though small plant, much more is such equipment necessary in Ontario for example, where the metallurgy of iron and steel are utterly unknown, and many attempts to establish furnaces have resulted in failures, redeemed from ridicule only by the patience and earnestness put into the enterprises. The educational facilities so far provided in Toronto towards making mining engineers will result in sending graduates abroad for experiment, experience and expatriation,—a result the country complacently sees attained in the case of a considerable number of young men who yearly leave the Royal Military College at Kingston, with an education most expensively given by the country, for professional service in the United States. An experimental establishment in metallurgy has been brought before the consideration of the Ontario Government. Would that they might rise above the level of political temperature to the appreciation of the honest directness and pugnacity of the remark addressed to Pip in *Great Expectations*: "Well! somebody must keep the pot abilin', Pip, or the pot won't bile, don't you know?"

Steel powder for polishing stones, and which can advantageously replace emery, is obtained by lightly sprinkling over-heated steel with water. The metal is thus made friable and reducible to dust by stamps. It is cheaper than emery and gives a finer and more durable polish.

The total coal production of the United States in 1890 is reported to be 140,229,515 short tons. This shows an increase over 1880, ten years before, of 97.57 per cent. The total number of 296,974 employés shows that a population of nearly or quite 1,200,000 people is directly dependent on the operation of the collieries.

A work of considerable interest to all interested in the subject of "Stones for Building and Decoration," has just been published from the pen of George P. Merrill, Curator of Geology in the United States National Museum. The work opens with a brief sketch of the early history of stone-working in the United States, followed by chapters on the geographical distribution of the minerals, and the physical and chemical properties of such stones as are utilized for general construction and decorative purposes. A systematic description of the rocks, quarries and quarry regions is given. Each variety of stone is taken up in turn, its composition, origin, structure and general adaptability for any form of work discussed, and the resources of each State and Territory described in alphabetical order. A special portion of the work is given up to the methods of quarrying and working; the machines and implements used in stone-working; the weathering of building stone; the selection of stone for building purposes, and the methods employed for the protection and preservation of stone from the ravages of time. The work is illustrated with eleven full page plates, drawn in most cases from photographs taken by Mr. Merrill, and eighteen figures in the text. The volume is indeed a most exhaustive and comprehensive treatise well worthy of perusal by the student, the stone-dealer, the architect, and all interested in the subject.

The minimum cost of electric lighting and electric power is attained where the water fall is used for transmission over comparatively long distances. The dynamo can be placed close to the water wheel and wires run to cities and towns for miles around. A company in Maine operating electrical plant by hydraulic means, furnishes power at 50 per cent. less cost than the average company in New England.

The evaporation of metals under electric stress was the subject of a paper by W. Crookes read before the British Science Association at the late Cardiff meeting. Premising that it is well known that in a vacuum tube furnished with interval platinum electrodes, the glass near the negative pole becomes blackened by the deposition of metallic platinum, he described experiments upon the evaporation of different substances. Taking gold as the standard, the following is the order in which metals volatilize:

Palladium....	108.00	Platinum.......	44.00
Gold.........	100.00	Copper........	40.24
Silver........	82.68	Nickel.........	10.99
Lead.........	75.04	Iridium.......	10.49
Zinc.........	56.96	Iron	5.50

In 20 hours, nearly 3 grains of silver were volatilized, and the deposit was easily detached from the glass in the form of brilliant foil.

The volatility and atomic penetration of iron when soldered with nickel, have been the subject of experiments by Fleitmann. The metals adhered so intensely it was impossible to separate them by mechanical means, and chemical analysis proved a perfect assimilation although the soldering had been done at a temperature 500° to 600° below the fusing point. Other tests showed the volatility of iron when heated to cherry redness. Two plates of iron and nickel superposed were submitted to the same degree of heat; the iron passed into the nickel to a notable extent without soldering or adhesion of the surfaces resulting. On the sheet of nickel an alloy with the iron was formed which penetrated ·05 of the thickness of one milimetre sheets and contained an average 24 per cent. of iron. The nickel did not pass into the iron, the plate of which remained intact and preserved the sombre appearance it had received from the heating.

It will be remembered that at the last October meeting of the American Institute of Mining Engineers, the accuracy was questioned of carbon determinations of iron or steel made by dissolving the metal in double chloride of copper and ammonium. The subject was referred to a committee, for which Mr. J. W. Langley reports that they are able to say, that all of the double chlorides of copper and ammonium they have examined contain tarry matter, (probably pyridial compounds), held in solution in commercial ammonia. This substance is retained by the carbon sponge, and causes the apparent carbon in the steel to be reported too high. The remedy is to use potassium chloride instead of ammonium chloride and make the solution slightly acid. The metal should be dissolved in a solution of double chloride of copper and potassium, to which 5 per cent. of its volume of strong hydrochloric acid has been added. A neutral solution of double chloride gives too low results.

So numerous are electric launches on the Thames that boats containing dynamo plants move up and down the river for the purpose of supplying the fluid. They can charge the accumulators of 6 launches at once. Electric welding is applied to the repair of broken saw teeth, thus saving the cost and labor of resetting. A device has been invented for preventing electric cars that have stopped on an up grade from running down grade before the brakes are applied. A push switch for electric lamps has been invented. There are two buttons, the white one lighting the lamp, the black one putting it out. To avoid the hissing in the arc lamp a carbon pencil has been invented containing a percentage of alkali silicate, which under combustion forms a conducting vapor that is said to prevent the trouble.

At the Sault Ste. Marie Mining Convention, Mr. Hammond, of Fort William, struck the right note in declaring that the great need of the Algoma district is a mining school. This great territory has surely money-borrowing powers, and can, under the Mining School Act of last session, do something towards laying the foundation for such a school. A recent paper on the Sheffield Metallurgical School will be noticed in our next issue, and will doubtless set definitely before the mining interests of Algoma the outlines of the educational institution they require.

The sustenance of the men thrown out of employment by the long continued strike at the Wellington collieries, has been the subject of wonder and comment by their eastern brethren. From the report of the financial secretary of the Miners and Mine Laborers' Protective Association, of the Island of Vancouver, we learn that the colliers have been receiving $25 for single, $12 50 for half members or boys who were working in the pits, and $3.50 for each child. The strikers have not, it would thus appear, been doing so badly after all; at any rate they have been receiving at least as much as would keep body and soul together without suffering, and more than that, many of them possess farms or small holdings, at which they have been able to grow many things for their own consumption. Under these circumstances, it was not to be wondered at that from 70 to 100 able-bodied miners should have been prepared to hold the fort for this extended length of time. Then, too, Mr. Tully Boyce, the leader of the miner's movement, has, it is stated, been getting upwards of $100 a month in wages and union allowances, since, whether he worked in the pits or not, he has had his wages made up to that sum out of the union funds, while he has been allowed liberal travelling and other expenses for visiting San Francisco and other places on business connected with the Association. Other officials of the union have also, it is said, received moneys for services rendered.

The question is put by the *American Manufacturer*, touching the furnace results of operations with finely comminuted magnetic ores, "Why may not equally good results, that is, comparatively, be obtained by a comminution of ores that cannot be concentrated? Why will not the Oriskany (earthy-red hematite) ores of Virginia work better in the furnace by charging them fine, or a large proportion of them? The theory of the action in the case of concentrates is, of course, that the gases of the furnace have more ready access to the particles of ore and reduce them more readily, while the melting operation and the fluxing out of the earthy matter is also more quickly performed by the greater ease with which the heat and flux reach the particles of earthy matter when it is in a fine state. This reducing the ores to a fine condition might be accomplished, in part at least, by roasting, and the ore then be freed at the same time from a large part of its moisture." These questions have been submitted to British furnace-masters in a series of papers by Mr. S. J. May, which have appeared in recent issues of *Iron*. He has conducted experiments on the magnetization of some hematites, by roasting, and discussed, with some show of probability, the economy of concentrating these ores by the magnetic operation. The subject deserves careful investigation. The preparation of ores for the blast furnace is a subject becoming daily of increasing importance, especially in Alabama, Tennessee and the Atlantic States.

The demolition of rocks under water without explosives, has been successfully effected on the Suez Canal, where the interruption of navigation and the danger of injury to neighboring constructions from blasting operations, rendered some other method necessary. A paper in the *Scientific American Supplement* gives the leading details of the system contrived by Mr. Henry Lobintz, for shattering rock by the action of rams let fall from a convenient height and acting like an artillery projectile upon the wall of a fortress. In a preliminary experiment at Craigmillar quarry near Edinburgh, it was found that a ram of two tons weight, shot with a steel point, falling 18 feet, broke up more than one seventh of a cubic yard of hard rock at a blow. The application of this method under water, obviously modified the conditions of the experiment. At the eastern end of the canal, a conglomerate of gypsum, sandstone and shells, composing the bottom, was found of too great elasticity for the pointed battering rams, the blows making holes from 6 inches to 2 feet in depth, but leaving the rock intact between the holes. By operating the dredging buckets very near the rams and simultaneously, improved results were obtained, expressed in cost at 84 cents a cubic yard, not including charges for insurance, interest and depreciation of plant. Better results were obtained where the rock presented a face more easily disintegrated and permitted the operations of dredging and battering to be carried on separately, the working expense being thus reduced to 65 cents a cubic yard. The system offers some appreciable advantages for work in ports, rivers and canals, and even for rock cutting in the construction of railroads.

After an experience of some years' duration natural gas is about to disappear from the mills and manufactories of Pittsburg. As a fuel for manufacturing purposes, natural gas is almost ideal, but its supply seems likely to prove precarious, and the companies which purvey it prefer to deal with domestic consumers rather than with works and factories. This preference is quite natural when it is stated that private consumers pay 20c. per 1,000 cubic feet, as against the 10c. paid by manufacturers. To the latter class of consumers the price was raised on October 1, to 15c., which alteration is held to mark the end of the use of natural gas for manufacturing purposes, as supplied by the companies. Various concerns who have their own sources of supply will continue to use natural gas as long as they can get it, but according to the American journals, it is no secret that the supply is rapidly diminishing. If that is really the case, it is patent that the reign of natural gas will soon be over. Even in that event, however, there can be little doubt that the use of gas as fuel will be established, and manufacturers will resort to producer gas rather than return to coal and coke. The largest supplying company evidently anticipate that result, as they have plans all ready for the manufacture of fuel gas at Pittsburg directly the price of natural gas reaches a point equal to the cost of fuel gas. "For puddling and heating furnaces," says the *Ironmonger*, "gaseous fuel is fairly certain to be used, owing to its economy, efficiency and cleanliness, but it is doubtful whether gas can compete with coal for steam-raising purposes. Improved furnaces are aiding the use of coal very greatly, and lessening the difficulty in respect of smoke, hence on both sides of the Atlantic the broad results are likely to be very similar at no distant date."

The Readman-Parker process accomplishes the manufacture of phosphorus by disassociating the elements of mineral phosphates by means of the electric current. The dynamo used for producing the current gives 400 units of electrical energy, equivalent to 536 indicated horse power. The electrodes are bundles of 9 carbons, each 2½ inches diameter, attached by casting into a head of cast iron. The carbons weigh 20 lbs. each, and are 48 inches long. The furnaces are rectangular troughs of fire brick, 60 in. x 20 in. x 36 in deep. Into each end is built a cast iron tube, through which the electrodes enter the furnace. These are geared for advance into or withdrawal from the furnace. The raw materials such as phosphates of lime, magnesia and alumina, are introduced into the furnace and the furnace and the current turned on. Shortly afterwards indications of phosphorus appear. The vapors and gases pass through large copper condensers, the first filled with hot, the second with cold water. As the phosphorus forms it distils off from the mixture, and the residue forms a liquid slag at the bottom of the furnace. Fresh material is introduced, and the operation is a continuous one, and may be worked for days without intermission. The crude phosphorous obtained is nearly pure, and is readily refined in the usual way. Each furnace yields about 1½ cwt. phosphorus per day. The phosphorus in the slag seldom exceeds 1 per cent.

Search for oil in Colorado is prosecuted with diligence and success. At a depth of 1,400 feet oil has been struck on Plain Creek, five miles south of Littleton. Developments are eagerly looked for at Denver, because of the proximity of the wells, and the altitude being 500 feet higher than the city, the product could be piped at minimum cost. Discoveries of petroleum are reported from Alabama.

A vast heap of abandoned machinery, such as pulleys, sprocket wheels, conveyors and screens, which had been thrown out of the mill, caught the attention of a representative of the *Engineering and Mining Journal* on a recent visit to Edison's Concentration Works at Ogden, N.Y. "The abrasive action of the fine grains of magnetite and rock and the friction of the bearings had not been properly provided for, and the machinery failed by wearing itself out in a very short time." The writer of this note having visited these works would also mention the costly wear of immense belts used as horizontal conveyors, the expense of which could have been much diminished by the use of shallow metal trays carried on narrow belts or wire rope. "The machinery is now undergoing reconstruction and is not at present in operation." Dr. Raymond's all too general criticism of magnetic concentration of iron ores may be justified in view of the history of the Ogden mill, but there are now in operation a sufficient number of such works to enable the engineer to determine the character of the appliances to be used in the presence of a particular ore, and the economics of the results to be kept in mind in order to win profit. The eminent quality of Dr. Raymond's criticism of any process is well known; nevertheless there seems to be sufficient ground for the belief that the process of magnetic concentration has a wide field of successful work before it.

The water jet has been long in use by the well-borer for assisting the descent of the drill and carrying off the spoil. In what is called the hydraulic process the drillings are pumped up through the drill rods: in the jetting process the water is forced down the drill rods and washes the drillings up and out of the outside casings. It would seem an easy step to the use of this method for helping the pile-driver. On the Manchester ship canal now under construction some 13,000 piles, 14 inches square and 35 feet long, have been driven through sand by the use of the water jet principle. Four steam pumps delivered the water at a pressure of 30 lbs. through 2-inch rubber hose to the pile, where it was attached to a 1½-inch iron pipe, which was put down under water pressure alongside the pile. With this assistance the steam pile engines quickly drove the pile, which, without the disturbance caused in the sand by the water-jets, could not be driven. At Atlantic City, N.J., the water jet has been applied to the driving of piles for a board walk. Water was brought from the city works in a 2-inch pipe, to the end of which, as the work progressed, was attached a 30-foot length of hose, ending in a common brass nozzle, 4 feet long, with an opening of 1¼ inches. The piles were swung into place by a light tripod, with block and fall, and steadied by the foreman, while one of the men held the nozzle of the hose vertically and close to the foot of the pile. Under the action of the jet the pile was lowered almost as fast as the men could pay out the rope, the nozzle following it down. The instant this was withdrawn the sand packed around the pile, holding it apparently at least as firmly as if driven by a ram in the usual way.

At an altitude of 12,500 feet the Virginius mine in Colorado is lighted and the concentrator, saw mill, pumps, hoisting and other machinery operated by electricity, and a great saving of costly fuel effected.

The great dam under construction across the Colorado River at Austin, Texas, will be 1,150 feet long, 60 feet high and 18 feet wide at top. The dam, hydraulic canal, gate house and other works will cost $800,000. The water power will be used for electric light for the city, for operating the street railway system and pumping the city's water supply, and it is expected there will be an available surplus of 13,000 horse-power for driving factories.

Mr. W. A. Carlyle, a graduate of McGill, and a few years ago a member of the staff of our Geological Survey, has been appointed to the chair of Mining Engineering at McGill. Mr. Carlyle has, since he left the Survey, been employed in mining work in the Western States.

The production of pig-iron in Great Britain and the United States for the first half years of 1890 and 1891 compare as follows:

	1st half 1890.	1st half 1891.	Decrease.
Great Britain, tons .	4,168,464	3,812,787	355,677
United States, " ..	5,109,775	3,776,556	1,333,219

In the first half of the current year Britain had actually reached an increase of output of 106,121 tons of pig-iron over the last half of 1890. There has been an increase of 25,136 tons of open hearth steel, and a decrease in Bessemer steel of 132,275 tons at British furnaces during the first half of this compared with the same period of last year.

Carnegie's Homestead Steel Works, on 1st Oct., cast a 25 tons nickel-steel ingot without a flaw. It will be rolled into a single plate for a United States war vessel. Another ingot, 50 tons weight, has since been cast and rolled into plate 13 inches thick for the same vessel. This establishment is said to be far more successful in its operations with the famous nickel steel alloy than similar works in France.

Railway building has fallen off in such a marked degree in the United States, and locomotive and car building work is so dull in the face of bountiful crops, that our neighbors are seeking for "radical reasons" for this state of things. Some think that the railroads cannot hold out much longer, but must soon enter the market with demands requiring large quantities of iron and steel, and that within a few weeks the iron trade will be pushed into a degree of activity bordering on a boom.

The literature of tin enterprises has for years been an interesting feature in the columns of American trade papers. The Pittsburgh *Dispatch* produces figures to show that the Welsh tin plate manufacturers have been making from 33 to 45 per cent. per annum. The industrious tinners of South Wales would give a good commission for the production of such vast profits in their business or for information as to how they can be attained. Virginia, fruitful in booming cities, basic steel works and other new enterprises, will not let Chicago walk at the head of the race for the name of home-made tin-plate manufactured from the great Horney Peak tin ores, and therefore no one need be surprised to learn that at Savernake, Va., there is a million dollar organization to build steel and tin-plate works, composed of "leading American and English" (of course) "business men." It cannot be denied that it is all that is claimed for it, —"An enterprise of great magnitude and of immense value, not only to Savernake but to the whole South." Nevertheless, there are enterprises more likely to be profitable in the development of the vast resources of the grand Old Dominion than the manufacture of tin-plate.

From the *Critic* we learn that Mr. Lucius Boyd, a mining engineer "from Dublin," is now in Nova Scotia, and that his advent is regarded as "likely to lead to most beneficial results." The same great authority says, "Mr. Boyd has been very extensively engaged in lead mining in Spain and his descriptions of the old Roman workings found there and modern mining are most interesting." This will be good reading in the Eastern Townships, where Mr. Boyd has undeniably a great reputation as a story-teller. Many will doubtless be curious to learn if the genial Lucius included in his "yarns" any reference to that paragon of "*modern mining*," the White's Asbestos Company? The *Critic* might kindly inform us on this point.

Although American mining engineers have dealt successfully with many great problems, it may be doubted if this country can show a mine in which such advanced ideas have been introduced as are in use at the Lumpsey iron ore mine of Bell Brothers, in the Cleveland district of England. The mine was recently visited by one of the English engineering societies, and the workings were fully described by the *Engineer*. The shaft is 564 feet deep, about 250 hands are employed in the mine and 1,000 tons of ore are raised in a day of eight hours. The hoisting engine has two cylinders forty-two inches in diameter and seventy-two inches stroke; the hoisting drum is a cone of seventeen feet diameter at one end and twenty-one feet at the other, and a gross load of eight tons and twelve hundredweight is raised in thirty seconds. Steel girders weighing fifty pounds to the yard are used in place of timber for supports in all the main galleries, the increased first cost being 35 per cent. All the hauling in the mine is done with an endless steel cable. All the drilling is done by mechanical means, hydraulic power being chiefly used. In sinking the shaft the inflow of water caused considerable trouble, but the springs are now utilized in driving the drills. A series of six inch pipes take the water about 260 feet above the bottom of the pit, which gives a pressure of about 215 pounds per square inch at the bottom of the shaft. From that point the water is distributed through the mine to the drilling machines. One of these machines will drill seventy holes 1¾ inches in diameter and 56 inches deep in a shift of eight hours. Drilling machines driven by petroleum engines have also been introduced, doing about the same work as the hydraulic machines. The ore vein is nine feet thick, but the ore yields only 30 per cent. metallic iron.

By a method invented by Mr. Oncken, casks are now made from one piece of wood, or to be accurate, the whole of the body, with the exception of top and bottom, is manufactured from one piece of timber. The stem of the tree is first cut into logs of the length of the barrel required, and is then boiled for two or three hours in a closed vessel, to soften the wood, a current of electricity being passed through the water the whole time. From the boiler the log of wood is taken to the machine, and as it is revolved against the blade a continuous sheet of wood is produced of any thickness. The wood is drawn out flat from the rear of the machine by hand, on to a table. The sheet thus obtained is cut transversely into pieces of the desired length for a barrel. The pieces are then passed through a machine, which cuts the groove in which the head is eventually fitted. Another machine cuts narrow V-shaped pieces at intervals out of the edges of the pieces of wood, which are then easily bent round into a cylinder and firmly hooped, the V-shaped slots enabling it to assume the necessary conical form at each end. There is thus only one joint in the body of the barrel.

Do shadows of the Land League and of boycotting secret societies rest irrevocably on Irish mining enterprise? and if not, how else can the result of the auction sale of the Slicourdagh collieries and the Knockmahon and Ardmore (? copper) mines on the 17th September, ult., be accounted for? The collieries are said to be of great extent in Tipperary, and "to contain a comparatively unlimited quantity of anthracite coal, and culm of excellent quality, free from sulphur. A great portion of the country over which the company's rights extend has so far been unworked for minerals. A large number of cottages stand on the property. The coal beds are near the surface and easily worked, and the collieries are still in working order." The Knockmahon mines in Waterford County are said to have been worked to advantage and to afford opportunity for further exploration. The collieries were knocked down to Mr. Richard Dodd, an English buyer, for £1,010, and the Knockmahon and Ardmore mines to Mr. Edward Spays, M.E., for £50 sterling.

The Witwatersrandt, South Africa, gold mines produced last August 59,070 oz., the largest monthly output yet reached. The district has turned out in three years and eight months 1,577,534 oz. or roughly, $27,500,000.

Gold reefs have been discovered in Errisbeg Mountain, Connemara, Ireland. The reefs are "from 1½ feet to 6 feet wide, showing gold free and in a pyritous matrix," yielding from 4 dwts. to 8 dwts. a ton. Experiments are in progress to see if this yield will pay expenses.

Prof. John Nicolson, B. Sc. (Edinburgh), has been called to fill the Workman chair of Mechanical Engineering at McGill University, Montreal, vacated through the transfer of Prof. C. A. C. Wilson to the W. C. McDonald chair of Mechanical Engineering.

The Norwegian government has prepared a plan for expending during a series of years £5,500,000 in railway construction. The imports of the country, which have increased nearly three millions sterling in three years, amounted last year to £11,594,117, and the exports to £7,284,129. The Swedish iron trade is in a healthy condition, and it is expected the year's make of Lancashire iron will be disposed of without reduction in price. In fact there has been a recent advance in hammered iron of 2s. 6d. a ton.

CORRESPONDENCE.

Mining Notes From New Brunswick.

Without preamble let me say that mining in New Brunswick is comparatively of small dimensions, but there is hope for the future. The mining resources of the province have long lain dormant for want of a full and complete mining law. Last session this was remedied to a great extent, and a Mining Act passed similar in all respects to the Nova Scotia mining act—the only observable difference being in the royalty on gold, which is placed at 2½%, whereas in Nova Scotia it is only 2%. Much dissatisfaction is expressed by many land owners at the new Act, as by old statutes enacted some years ago, all minerals on private lands were vested in the owner. The fact of it being so, however, never seems to have stimulated the mining industry in the province, hence the repeal of the same, and a general Act empowering the Government to issue rights of search, prospecting licenses, and leases on all lands, both private as well as Crown lands.

It is said the Act will be, in many respects, amended during the coming winter. What is done will be fully reported to you at the time.

Since the passage of the Act, many persons have availed themselves of its requirements, and numerous applications for areas have been filed in the Surveyor General's department, over which a number of disputes have arisen already and which are being fully considered.

Many persons in the province itself, are unaware of the existence of the mineral deposits of New Brunswick, but within its borders may be found most positive traces of gold, galena, copper, manganese, iron, coal, (both hard and soft), gypsum, baryta, antimony, iron pyrites, plumbago, nickel; and traces of tin and asbestos have been met with from time to time. In addition to this there is strong indication of petroleum, natural gas, salt beds of importance, brine springs, from which the best salt in Canada can be manufactured, mineral springs in abundance, and granite and freestone quarries of the greatest value, and limestone in almost inexhaustible abundance.

But of all these, few have been developed to any important extent. The chief development having been in manganese, gypsum, and the granite and freestone quarries in the province.

The famous Albertite coal of Albert County, at one time was the most extensive mining operation ever conducted in the province, from which thousands of tons of the precious Albertite was extracted, and its stockholders became very wealthy from its operation. The supply of the mineral, however, gave out; the mines were abandoned and all the costly machinery in due time removed and sold. Indications of this mineral are still to be met with in Albert, Westmoreland and King's County, and much time and money has been spent in prospecting for it for years past. There are many who believe it will be found again in sufficiently large quantity to pay for working.

In various parts of the province work of exploration is going on quietly for different minerals.

At Woodstock, in Carleton County, a local company has spent considerable money in developing a galena deposit, which gives good evidence of being productive. They have gone down about 150 feet and are diligently continuing operations to prove the value of the mine.

In Charlotte County, at St. Stephen, much activity is being displayed in the development of an iron pyrite body which, to say the least, is attracting considerable attention from home and American capitalists. The ore, which seems to be a combination yielding copper, silver, with occasionally some gold, and a fair percentage of nickel, is of very large extent, being quite near to shipment, and in one case on what is known as the Hall farm, has shown a width of about 250 feet, and can be distinctly traced for some distance. Numerous assays have shown from 1% to 2½% at times of nickel, and considerable work of development has been and is now being done. A number of properties it is said, have been bonded to American capitalists. What the final outcome may be it is hard to state, but many are confident that a body of ore, rivalling to a certain extent the famous nickel beds of Sudbury, are in this locality. One thing can be stated with accuracy, and that is that the ore from the Sudbury district and the St. Stephen ore are exact counterparts of each other so far as looks and appearances go.

In King's County, near Sussex, manganese exists in abundance.

The Markhamville mines, which have been worked almost continuously for the past thirty years, are at present not showing up very well. It is said by many the ore is exhausted, while others scoff at such an idea. In other sections large bodies of manganese exist and only await the advance of the capitalist, and a market demand which, while frequently fluctuating, seems very quiet at present. This mineral also exists in good quantities in Albert County and some portions of St. John County.

In Gloucester County exist splendid beds or belts of magnetic iron, and also every appearance of large and good paying galena belts, some of which are being quietly tested, so it is stated, by American capitalists. On one of these veins or belts, assays of the ore have shown a yield of from 10 to 60 ounces of silver, and from 12 to 15 dwts. to as high as 2 oz. and more of gold in combination.

Below St. John, for many years past, considerable money has been spent in the search for anthracite, and those interested firmly believe their efforts will be crowned with success.

In York County, it is beyond doubt that valuable deposits of antimony exist. In past years mining operations were conducted there, but the matter assumed more of a stock gambling operation than that of legitimate mining, and together with reckless and extravagant modes of mining, the enterprise got a "black eye" so to speak, and that coupled with the holding out for fancy and extravagant prices by the owners, killed all efforts in this direction.

In other parts of the province explorations are being made for gold, and it is confidently believed the day is not far distant when it will be discovered and mined with paying results. The regions of the Upper St. John River, the Tobique and the Nashwaak and upper branches of the South West Mirimichi rivers are considered favorable grounds for prospecting, and there will be considerable time and money spent in these sections in the near future.

The gypsum deposits of the province are being worked to quite a large extent, particularly those of Albert County, near Hillsboro, and at the Plaster Rock, so called, on the Upper St. John, to which a railway is now being constructed.

Taken as a whole, the mining outlook for New Brunswick is fairly good, and it is to be hoped that when a chance for capital does ofter those owning or controlling mineral deposits, will not frighten capitalists away by asking fancy or extravagant prices or refusing bona fide offers of development which would result favorably all round. This course has, in the past, greatly retarded the development of many claims that might prove remunerative, and when mine owners can get themselves down to a common sense basis on undeveloped properties, they may realize that it is the best course for all concerned.

Hoping I have not occupied too much of your valuable space, and with the promise that you shall hear from me again if my notes meet with your approval,

I am,
Yours, etc.,
CRYSTAL.

FREDERICTON, N.B., 21st. Oct., 1891.

P.S.—I shall be glad to answer such inquiries as readers of your journal may be pleased to make through your columns at any time.

C.

Mining at Illecillewaet, B.C.

West Kootenai District has been well to the front lately owing to the two magnificent displays of exhibits of the ores of the district at the Toronto Exhibition, and also at Westminster, B.C., and Victoria, B.C., The Illecillewaet District was well to the fore in the display of high grade galena ores, and though some forty or more claims were represented from Illecillewaet, it is not a fifth part of the number of known mineral-bearing claims that could have been shown if more time had been taken to collect specimens. It was an excellent indication of what an enormous value to the Province of British Columbia is the apparently inexhaustible wealth of her mines. That so much should have been done at a short notice conveys an excellent idea of what could be done in making a grand display if needed, for there was no attempt made to collect specimens for an exhibit until about three weeks before the exhibition opened. Great credit is due to the energy shown by all parties in promoting the success of the exhibition. The Hon. J. Robson, Premier of British Columbia, takes a deep interest in the development of the mining industries of the province, and most cordially supported the idea of an exhibit, and made a special grant of some $350 to pay the expenses of collecting the specimens. The sinews of war being thus supplied, the work was at once taken in hand and competent men told off to the different districts to collect and bring the specimens to Illecillewaet, which was the centre of the district. Here, under the able and intelligent superintendence of Mr. J. M. Kellie, M.P.P. for West Kootenai, himself a practical miner, the specimens were duly certified, labelled and packed for the two exhibitions, the C. P. R. generously carrying the specimens to both places free, in a special car. The weight of the samples sent to Toronto was 2,040 lbs., and to Westminster, 2,010 lbs. The samples, on arrival, were officially assayed. I quote a few of them: Oak Leaf, Illecillewaet (Messrs. Jowett & Haig), 40 oz. to 400 oz. silver; Maple Leaf, Illecillewaet (J. MacKinnon), 60 oz. to 90 oz. silver—60% lead; the Gladstone, Illecillewaet (Messrs. Kennedy & McCarty), 60 oz. to 1,100 oz. silver and 60% lead; Crystal, Illecillewaet (Messrs. Corbin & Kennedy), 60 oz. to 80 oz. silver, and 60% lead; Homestake, Illecillewact (Mr. C. Taylor), 100 oz. silver—40% lead; the Ottawa, Illecillewaet (Mr. Walter Scott), 150 oz. silver and 70% lead; Dunvegan, Illecillewaet (Messrs. Boyd, Bain & Co), 70 oz. to 115 oz. silver—60% lead; Spanish Fly, Illecillewaet (Messrs. Gallop, Jowett & Haig), 20 oz. silver and $10 gold; the Sanquhar, Illecillewaet (Mr. Walter Scott), 70 oz. to 110 oz. silver—65°/o lead; the Maple, Illecillewaet (Mr. D. Walsby), 60 oz. silver and 40% lead; the Elizabeth, Illecillewaet, Fish Creek (Mrs. Walter Scott), 139 oz. to 175 oz. silver, and 71% lead; the Gold Queen, Illecillewaet (Messrs. Stark & Taylor), 20 oz. to 286 oz. silver, and $10 in gold; Blue Bell, Illecillewaet (Messrs. Gallop & Green), 70 oz. silver; Goat Cave, Illecillewaet (Messrs. Scott & Chisholm), 60 oz. to 80 oz. silver, and 40°/o lead; the Jumbo, Illecillewaet (Messrs. Corbin & Kennedy), 60 oz. to 1,300 oz. silver, and 40% lead; the Sprague, Illecillewaet (Selkirk Mining Co.), 150 oz. to 170 oz. silver, and 45% lead; the Whale, Illecillewaet (Messrs. Boyd & McKinnon), 70 oz. to 1,000 oz. silver—30% lead; and many others, but I think that these will show that there are some excellent prospects in this district, or this part of it. There was also a splendid show from Ainsworth, Hot Springs, Toad Mountain, and the exhibit from the famous Silver King Mine was quite a feature of the exhibition. Last year this district received a medal of merit at Toronto for the best exhibit of mineral ores, and it will not be far behind this time. All who have seen and examined these splendid specimens echo the sentiment expressed by one of the leading smelter men of the State of Washington, that the West Kootenai District is the most promising mining district on the American Continent. The great drawback to the prosperity and development of these claims is the want of means of communication by trails and roads. This is being gradually overcome, the B. C. Government voting as much money as it can for this purpose, and work is slowly but surely progressing in this direction. It is a most important work and should receive special grants, for there is nothing that would sooner repay the outlay than free communication between the various mining camps. Let that once be fully established and then development work will begin in earnest; population will come in and every branch of trade and business will receive a grand impetus. Mr. S. S. Ryckman, M.P., of Hamilton, Ont., has favored us with a visit, having heard of the great value of our silver deposits, and thought that he would like to see for himself that the facts warranted the favorable reports that he had heard. Mr. Ryckman is most favorably impressed, both with the extent as well as the value of the mines in the Illecillewaet District, and no doubt when satisfied, will become an important shareholder in some of the leading mines, thus giving an impetus to the development of the district and setting an example that it would be both well and wise for others to follow, as there are no "wildcat" ventures here: every prospect shown has a substantial backing of galena-bearing ore. A little time and these mines are bound, from their extent—being true fissure leads, the high grade of the ores and the facility for transportation given by the C. P. R. when the ore is once at the foot of the mountains—to be the centre and scene of busy, bustling, active life, for nothing can retard for any length of time the introduction of capital for the development of the mines. There is this important, and may-be neglected, fact to be considered when looking toward British Columbia as a field for mining investment, and that is, that this country was almost unknown, except to an occasional hunter or trapper, and really only dates as a known and determined locality, for about five years. So that it is rather early to cry out because not many people come here. The reason is not far to seek: they are entirely ignorant on the matter, and it requires a little time to instruct the public mind and convey the knowledge that there *is* such a place and that *there* are located mines of exceptional richness and value, which offer every inducement to the large or small investor, with the certainty of a remunerative return for money invested. At the new locality of Fish Creek there are now twenty-two claims located and recorded. This is bound to be a big district when developed. I will send you a detailed description shortly of what will be a place of note in mining circles in the near future. The new trail is being carried towards the arm of Trout Lake, and is now down over twenty miles from Flat Creek, where the old trail comes in. Two substantial bridges have been built, and next year the communication with the Lardeaux district, and thence to Kootenai Lake, Toad Moontain, etc., will be opened to parties on foot or horseback. A most interesting discovery has just been made some eighteen miles down the trail in Fish Creek, and that is of a geyser, which throws an enormous body of cold water into the air to the height of about 60 feet—a natural curiosity well worth a visit. In fact the whole of this district is most interesting, and when once known will draw tourists from all parts to see the wonders and beauties of the Almighty's works. There is good sport also, for cariboo and bears are numerous, and a determined and fearless sportsman could have fine sport, especially this time of year. We can appreciate caribou, but the bears are a dangerous nuisance that we try to exterminate wherever we meet or see them. By the way, some of these gentry paid a visit last week to Albert canyon and appropriated two fine, fat pigs belonging to one of the section men and which he had been fattening for his winter supply of pork. Mr. Bruin came and the result is, the bear is so much fatter and the section man so much poorer. There had been a heavy snowfall on the mountains that had driven the bears down into the valleys. I had a narrow escape myself from a big cinnamon bear last week. It is not safe to go out here without a good rifle.—Quite a chapter on bears.

The Selkirk Mining Company's claim, the "Lanark," is now on a rich body of ore, and is the very best evidence we have that our mines only need developing. The Selkirk Co. has spent some $250,000 on this property, and will soon be getting some valuable returns for the outlay. They have two tunnels driven in from the side of the mountain to the lead—one, 300 feet below the surface prospect, and the other, some 300 feet below that. A shaft sunk from the surface, in the ore, is some 600 feet in depth, and they have now a body of ore in sight 30 feet wide 300 yards long, and some 600 feet in depth. The average for this claim is from 60 oz. to 80 oz. silver—60% lead. This is the only proved and developed mine here yet, and the result is most encouraging to all mine owners. The mine has been working for about three years—for the last two years under the able superintendence of Captain Eva, a gentleman well known in the States of Utah, California and other western States, as one of the most capable and skilful mine managers on the American Continent. A Cornishman by birth, he has been working amongst mines and mining of all kinds of mineral from the time he was ten years old—that is some fifty years, as he is now some sixty years of age. An aerial tramway is to be erected to bring the ore from the hillside down to the C. P. R. track, and next year will find this mine delivering ore at the rate of 60 to 100 tons per day.

The "Jumbo," owned by Messrs. Corbin & Kennedy, has been placed in the hands of an English syndicate for the sum of $200,000, and this mine has had some $25,000 expended on it. Taken altogether, the prospects of Illecillewaet are very healthy, and all point to a full spring-tide of prosperity, wealth, and stirring business in a very short time.

There is no chance here for doctors, as no one ever dies —country too healthy. E. A. WATSON.

ILLECILLEWAET, B.C., Oct. 7th, 1891.

Florida Phosphates.

SIR,—The September number of the *Review* has just reached me.

The phosphate items are of particular interest.

The position as regards Florida is becoming particularly interesting. The general demoralization existing among consumers in Europe, produced by the exaggerated and "booming" reports so assiduously spread by the Floridians, is perhaps less intense than it was, but there is still room for great improvement. The Floridians themselves are now beginning to realize the injury they have wrought, and a general closing down of mines seems imminent. How very absurd the exaggerated statement of "shipments of 300,000 tons from the Hard Rock field during 1891," made by a prominent phosphate land operator early this year, is best shown by the annexed statistics, which are absolutely correct.

Present indications favor a somewhat better market, but notwithstanding this, some of the Florida companies continue to offer the article down. As novices in the export trade they fail to see that a price of 11¼d, with freight at 29s. (actual rate paid), is materially less than 10½d., with freight of 17s. 6d., which was about the average rate during 1890 from Fernandina.

I consider that I am perfectly correct when I say that there are to-day not 15,000 tons of $\frac{75}{80}$ rock overground in the state of Florida; and further, that the entire output of such material for the year 1891, including what has been shipped thus far, will not aggregate 60,000 tons from all sources.

Shipments of phosphate rock from Fernandina, Florida, mined in Citrus and Marion Counties of $\frac{75}{80}$% test:

1890			1891		
May........	3,510	tons.	January	1,771	tons
August......	983	"	February.....	1,680	"
September...	1,452	"	March........	3,851	"
November ...	1,472	"	April........	4,616	"
December ...	2,331	"	May.........	3,632	"
			June.........	4,275	"
Total....	9,748	"	July.........	4,265	"
			August.......	3,050	"
			Sept. (to 17th)	4,325	"
			Total....	31,465	"

Yours, etc.,

NEW YORK, Oct. 9th, 1891. LOUP.

◆

Cooling the Air of Mines.—The effectual cooling of mines is a subject which has long occupied the minds of engineers. An invention of some moment has been introduced to the managers of the Cornish mines by Captain Williams, and is one very likely to become adopted by colliery managers also. The machine is a simple one, and the moving parts are enclosed in a large upright box, and may be made in different sizes to suit the requirements of particular mines. Within the box is a cup-shaped cylinder which swims in water, whilst the motion of the piston-rod, actuated by steam-power, produces a strong current of air at both its upward and downward strokes. It can be placed at any required depth in the mine or colliery, and receives its full supply of air from the surface. No grease or oil being used, the air is, of course, preserved in the same condition as supplied. The under portion of the machine always contains about 6 ft. of water, and the up-stroke of the cup-piston going to the top of the machine, with the water running down the sides, keeps the inner part of the machine deluged with water, by which means the air is cooled before it is delivered into the mine; even to a temperate heat in the hottest summer. The inventor claims that the machine will force some 5,598,720 cubic inches of cool air into the interior of the mine, each minute, or that it will only require an engine of some two-horse power to deliver from 7,000 to 8,000 cubic feet of air into any part of the mine or colliery per minute. The machine will be thoroughly tested during the next few months.

Preservation of Mine Timber.—Experiments made at the Altenwald Colliery, Saarbrücken, of coating mine timber with lime, coal tar, wood tar and carbolineum, proved that lime was the worst and carbolineum the best preventative against dry rot. The cost of a double coating of carbolineum to a prop of 8¼ feet in length and 10 inches in diameter was 6d. for the carbolineum and 1¾d. for labor. At various mines in Saxony not only are the supports wetted occasionally to prevent dry-rot, but the wood is first impregnated with a solution of ferrous sulphate before being put into use. This method of treatment has been adopted for some time and has been found to give very good results.

Nova Scotia Gold Fields.

[Interesting Address By Mr. ALFRED WOODHOUSE, F.G.S., at the October meeting of the Gold Miners' Association.]

During the past month there have not been wanting evidences that the gold industry of Nova Scotia was about to be boomed.

Several foreign engineers and promoters have visited the Province, and have been practically unanimous in their favorable opinions of the chances for gold mining. At the October meeting of the Gold Miners' Association an invitation was extended to Mr. Alfred Woodhouse, F.G.S., of London, Eng., to address the Association on the subject of their industry, which invitation was accepted, and we have secured a copy of his remarks which we herewith present to our readers. It must be borne in mind that Mr. Woodhouse's experience largely relates to South Africa, and that that is a country of large veins; nevertheless, the truth which Mr. Woodhouse so clearly reiterates cannot be too often impressed upon mine owners and managers.

Mr. Alfred Woodhouse said that it was with some diffidence he ventured to give his impressions of what he had seen in Nova Scotia, considering how short his visit had been. He would, however, begin by stating that so far as he had gone he was decidedly favorably impressed with the future prospects of the gold mining industry of this Province. The formation here was decidedly favorable, and the output of gold in the past conclusively proved that the province had an industry that deserved even more attention than had been given it up to the present time. There was every justification for outside capitalists to invest their capital in developing these gold mines.

He warned them against offering to outside capitalists the worst of the mines, as if this was done, capitalists would very quickly be disgusted. The first principle which should guide those interested in securing the co-operation of outside capitalists should be to give them something with which they would be so satisfied that they would come again and want more.

So far as he had seen, comparing the lodes in Nova Scotia with those in other countries, he had every reason to believe that the leads in this Province would continue to great depths. He would not go so far as to say that they are fissure veins, but at the same time it did not necessarily follow that because they were not fissure veins they would not continue down to great and unworkable depths. Compared with other gold fields the veins here were a little thin. At the same time the lodes were very close together. But the mines must be worked on a commercial basis. Twenty dollars' worth of gold must be produced for something less than twenty dollars, otherwise commercial failure was bound to ensue. He was sorry to say that he could not agree wtth the present system of working the mines. The system in vogue here might properly be called the preliminary state of gold mining. For instance—a prospector starts and finds a vein with some gold in it, and naturally follows on that gold until water or some other little difficulty prevents him from continuing, when he leaves that vein and goes to some other. This may be a very good practice so far as developing the district is concerned, but it is not gold mining. Any one going to a gold mining section of the country here is struck with the enormous number of these small pits which have been sunk on the surface of the veins, and as soon as they have gone down a few feet they leave it and go to some other spot, which is following out nothing more than the old primitive method of two or three thousand years ago. He thought that, with some few exceptions, the system might be summed up in the word "Fossicking." However, the work that had been carried out by these prospectors was of some value. They have proved that there is valuable gold existing in these localities, and that with proper system of working there is every prospect of permanent value attaching to these mines. After the prospector comes forward the small capitalist, who mines down to a certain point—about 200 or 300 feet—beyond which point he is a little nervous about going. This is simply because he has not that amount of confidence in the mines that the surface workings or the work above the 300-feet level should have given.

The gold in Nova Scotia, so far as he had seen, ran in streaks or gold chutes. He did not think that sufficient attention was paid to these streaks. Every piece of work that was carried out on a mine should be accurately planned. As the ore is removed it should be accurately marked on the plan, and not only marked on the plan, but the various yields of gold at the different points should be indicated on the plan, so that after a few months' work the line of that particular gold streak should be accurately known. He wished particularly to mention what he assumed was the same in this country as in other countries —that a streak of gold will pinch and make in the same way as the leads of the country will pinch up and widen out, and therefore when gold miners, in working, gradually ran to a point where the gold was pinched to a few feet in length, they should not be disheartened. It would be an extraordinary thing if the streak of gold did not again widen out as the workmen proceeded deeper. In a country like Nova Scotia, where, in the gold mining localities, there were so many leads close together, the system of working was wrong. He admitted that it was easier to find fault than to propose corrections and improvements, but he felt it his duty to distinctly express his opinion that the system of working the mines in Nova Scotia was unsound. The proper system of working where there were so many leads occurring together, was by means of vertical shafts, from which cross-cuts should be made to tap the various leads. From this main shaft drifts should be started on the various leads with a slight gradient up-hill, so that not only all the water drained to the main shaft, but with this slight gradient the loaded trucks could be run down easily to the main shaft, and the same truck raised and delivered at the mill so that there would not be a second handling of the ore. Instead of adopting that system here the present existing plan was that of inclined shafts. The objection to this is that if inclined shafts are sunk, the miner cannot tell what variations in dip the lode may take. It may start at an angle of sixty degrees and go to sixty-five and then come back even to fifty-five degrees. Was it not clear that the wear, tear and friction of the hauling gear would be very much greater by this system than by the other?

It would be a great advantage to the mines in Nova Scotia if more money was spent under ground, and not so much on the surface until it had been practically demonstrated what was actually below. After all it should be remembered that it was the mine and not the machinery that gave the dividend. He stated this with some diffidence, for they must not forget that gold-miners were perhaps the most obstinate and assertative people on the face of the globe, and "knew all about it," and if they did not nobody else did. (Laughter).

And now, another point that is frequently lost sight of. As ore is removed a certain amount of development should take place, so that when a hundred tons of rock are raised two hundred tons more would practically be put in sight, and in that way the reserves are always increasing. The cost of this extra development should be included in the cost of working the mine.

As regards amalgamation, the first principle is to check the forward flow of pulp as often as possible; the more you check, the more gold you will save. A matter hitherto neglected was the question of concentration. The concentration of ores was a most important matter. He saw by the statistics published that only some 60 per cent. of the gold was saved.* Now, by a little practical knowledge and experience, competent men were able to save an additional percentage of gold, and while the cost of saving such percentage was very small, the beneficial result to a company was very considerable in the course of a year. He suggested that the question of concentration should receive more attention than had been hitherto given to it. He might mention that during the night shifts, when everybody was asleep, the stone is fed into the battery, and is passed over plates to take its chance, and that is what some call amalgamation! Any ignorant man could do that. Put a "nigger" to work and tell him to feed the quartz into the mill and set the stamps going so many drops a minute, let the crushed ore run over a certain surface of amalgamated plates, and that is termed amalgamation! That is not amalgamation. Amalgamation is a science and must be understood and pursued as a science.

Another matter which has escaped general notice in this countay, and which should receive immediate attention, was the question of the alluvial deposits. As we see the country to-day, we notice that the contour of the surface is undulating or flat, but in former ages as one can see from the character of the drift, there must have been very high ground. Now these leads continued to much greater height, as amongst the drift, large masses of quartz are found. The drift here in this Province is perhaps unusually thick; but very little attention has been paid to it. During his visit, he had given particular attention to this matter, and he had found that in every district where he had been, there was always the same state of affairs. They do not know anything about cradles, sluice boxes, etc. They pan the gravel and obtain a certain amount of gold and some quartz. This quartz they break and only retain what shows visible gold. At Waverley, recently, he witnessed a man panning from the shores of a lake. His takes for the morning amounted to a few grains of gold and several small pieces of quartz showing visible gold. He asked permission to examine the results and ascertained that the yield was in value about $1.50 from the morning's work. That was obtained by the aid of a washing basin which was not more than nine inches in diameter. If a working man with such methods could achieve that result in a morning, what would a judicious outlay of a little capital effect?

It must not be forgotten that the gold in Nova Scotia was unusually coarse. He had been informed that a piece of gold had been taken out of a mine here, in weight 27 ounces. He had never seen a piece of gold coming out of a vein and weighing anything like 27 ounces. If such were the case and one such piece was found, there could be no doubt that there were plenty more. He stated that in his opinion, there was very good alluvial gold to be found in Nova Scotia, but it required looking for, and as soon as the Province could attract a desirable population by the discovery of rich alluvial in one place and another, a very important advance would be made in the position of the gold mining industry in Nova Scotia.

He thought Captain McDuff would bear him out when he stated that the great point to ascertain in connection with this is to learn where are the beds of the old rivers? Although rivers run north and south now that might not have been the case formerly. Where they ran north and south before they might now run east and west. He believed that if properly looked for, good alluvial fields would be eventually discovered in Nova Scotia.

[* Mr. Woodhouse gives no authority for these statistics, and hence we do not know to what country they apply, but in Nova Scotia the sulphurets, as a rule, run low and the percentage saved is nearer 75 than 60.—EDITOR.]

In conclusion he would state that they were too eager to handle the dividend and would not form any reserve fund and thus be ready for the rainy day, *which always arrives in gold mining*—and many mines are to-day closed down for want of forethought.

Capital was essential. He thought that a stage in the mining industry in Nova Scotia had been reached where deep sinking and permanent works must be carried forward, and in his opinion, the only way to obtain most satisfactory results was, as a rule, by sinking vertical shafts and working these mines as mines are being worked in other countries.

Gold mining operations, when of a permanent character, are generally beyond the compass of private individuals. In some of the mines of this Province, a working capital of not less than $100,000 was highly desirable.

He suggested that the Gold Miner's Association should petition the Government, urging the necessity of proving the quartz with the aid of diamond drills and thus afford encouragement to those who, by their enterprise, are swelling the Province's finances.

It had been practically proved that gold in large quantities existed in the mines of Nova Scotia, and all that was now necessary for the prosperity of the gold mining industry was to induce foreign capitalists to come forward and carry on the work that had been so well begun.

At the conclusion of Mr. Woodhouse's address, remarks were made by several other gentlemen, amongst them Mr. B. C. Wilson, of Waverley, and Mr. Ross, of Montreal. Mr. Ross, among other things, said :—

There were other products in Nova Scotia which were more directly in his line than the important product just treated upon so eloquently by Mr. Woodhouse. He cordially agreed with that gentleman's observations about the cross-cutting. There seemed to be a peculiar aversion among the miners of this country to cross-cutting, and though they may have good reason to believe that there is another lode within perhaps ten feet, they will not pursue the proper course and cross-cut to it, but would rather dig a little trench, when perhaps they already may have the depth secured, and it may only be a question of a few feet before their efforts would be rewarded. Some outside capitalists had come to this Province and done well. Others who had secured good mines let them slip through their hands by not working them properly. Other mines again, have been taken up and enormous amounts of machinery put on the ground before the owners really knew what they had to treat. They have been managed for the most part from thousands of miles away and not on the spot. Such a course would not do justice to any mine.

He had been pretty well over the whole Province in connection with other minerals of Nova Scotia. There were in this Province immense fields of coal and immense deposits of iron. There were also large quantities of manganese and antimony in some localities. These mines if properly operated would all pay and prove of great benefit to the country, but they could not be worked without capital. The people in Nova Scotia appeared to have a special preference for gold mines as compared with other mines, but there were other mines as well in this Province of great value. Capitalists, before investing any money in mines in a particular region, naturally ask what other mines are being worked there and what profits have they paid. There is no use to state that any particular mine would have paid had it been properly worked. The question is,—Have they paid? The wonderful mineral resources of Nova Scotia were not sufficiently known abroad. There were thousands of business men in London who may have heard of Nova Scotia, but know absolutely nothing of its mineral resources.

We import an enormous amount of iron from Europe for our own consumption, and he considered that the people here were capable of developing an industry which would be a benefit not only to Nova Scotia, but to the whole of Canada, and thus this Province could in that branch compete with the United States and Europe.

He had heard a great deal about other minerals and had received samples. Some were sent to him as asbestos which, he was sorry to say, were not asbestos; and also samples of tin, which, he was sorry to say, were not tin. (Laughter.)

There were comparatively large quantities of molybdenum found in this Province, but as yet no practical use could be made of it in the arts on a large scale.

There was one point concerning which he should like to see some definite stand taken. An official analyst and assayer should be employed in this Province. (Applause.) Nova Scotia derives a large part of her revenue from the mines, and he thought it was unfair that the Province which benefitted so largely from the operation of the mines should not expend a few hundred dollars in the employment of a public analyst to report on all sorts and descriptions of minerals sent him, and who might be the means of increasing the revenue of the Province by thus assisting in the discovery of valuable mineral deposits. Some of the greatest mines in the world had been brought before public notice by the discovery of valuable specimens by ignorant countrymen.

If such people could send their little findings to a public analyst, from whom they could get a straight report as to their value, a great amount of good might be done to the Province.

In this connection it would be desirable to have a museum where specimens could be sent for reference and a geological chart prepared, and thus the localities where the various minerals are situated could be more exactly designated than by the present system. (Applause.)

Mining in West Kootenai, B.C.[*]—Graphic Description of the Mining Districts and Mining Claims in this Promising new Field.

DR. G. M. DAWSON, GEOLOGICAL SURVEY OF CANADA.

The first mining claims were taken up at this place in 1883 by Thomas Hammill, afterwards murdered at Hendryx. These claims were situated near the shore of the lake, and were named the "Lu-Lu" and "Spring." Later in the same year claims known as the "Surprise," "Morning Star" and "Evening Star" were staked further back from the lake, and nearly on the line of what is now known as the Spokane vein. The ores discovered at this time were, however, rather low in content of silver, and it was not till the find of rich ores in Toad Mountain became known in the spring of 1887 that an impetus was again given to prospecting and high grade ores were discovered in this vicinity.

Nearly all the principal deposits since found here, some of which have been developed to a considerable extent, are included in an area extending from south to north between Coffee Creek to Woodberry Creek, a length of about six miles; from east to west from the lake shore to the vicinity of the "Sky Line" claim, a width of little over two miles. The number of actual discoveries of considerable bodies of good ore already made in this comparatively limited area is remarkable, and new finds are still occurring from time to time.

From the edge of the lake the country rises to the west in a long irregular slope, which, as seen from a distance, presents a series of step-like ascents, produced doubtless by the irregular denudation of a series of beds of unequal hardness. This step-like appearance, though also observed to the northward along the same side of the lake, is here much more marked than elsewhere. The region has originally been densely wooded, and in some of the hollows excellent cedar and white pine timber is still to be found, but since the occupation of the camp, most of the original forest has been burnt off, either accidentally or with the object of facilitating prospecting. A fairly good trail has been made from the lake shore to the "Number One" mine, a distance of about two miles in a straight line in a west-north-west bearing, the height above the lake attained at this point being about 2,520 feet. The course of the trail is, however, exceedingly sinuous, and besides the numerous sharp zig-zags necessary to overcome the steeper parts of the ascent, it makes a long sweep to the southward, and another to the northward before reaching the "Number One." Smaller trails and tracks branch off in various directions to other claims, and by one of these the ascent of the main slope may be continued in a south-westerly direction from the "Number One" mine to the "Sky Line" at an approximate height above the lake of 3,460 feet. No attempt has yet been made towards the construction of a waggon road, and such ore as has been sent out has been carried down to the lake shore on horses or mules. The best general section of the rocks of the vicinity was obtained along the main trail, measurements being made by pacing, but as there are considerable intervals in which no rock exposures occur, this still leaves much to be desired. The general strike of the rocks, which is preserved with considerable regularity, is nearly due north and south, but about half-a-mile below the "Number One" mine it turns gradually to a nearly north-west bearing, a change which, however, is probably local in character. The dip of the rocks is, almost without exception, to the westward, at an average angle of perhaps 45°. The inclination is, however, considerably less near the shore of the lake and probably also in the vicinity of the "Number One" mine, while further up near the "Sky Line," and in the vicinity of the edge of a granite mass to the west, the beds are much disturbed and crumpled, and often nearly vertical.

On the shores of the lake the rocks are coarsely crystalline, glittering mica-schists, often garnetiferous and in thin flaggy beds, dipping S. 77° W. < 20°[†]. Rocks of the same character and referable to the Schuswap series of the general section, are seen in a few places, and appear to be continuous for a distance of a little more than a quarter of a mile back from the lake, measured at right angles to the strike. A belt of green schists is then crossed, with a width of about 700 feet, and with westward dips at angles of 45° to 50°. A trail going southward toward the "Little Donald" claim branches off a short distance before the west edge of the green schist is reached and between this trail and the west edge of these schists the beds have irregular and sometimes very high dips. To the west of this belt of green schists the rocks appear for the most part again to consist of rather coarse mica-schists, to the vicinity of the "Spokane" mine, a further distance of 1,300 feet measured as before, directly across the strike. The "Spokane" mine is situated near the brow of a steep, step-like ascent of about 200 feet, at the foot of which runs a strong body of "barren quartz" and silicified rock, together with a wide dyke of augite andlesite, with large porphyritic crystals of black pyroxene and glassy felspar. It appears probable that some faulting may occur near this line, and that the strata so far described in ascending from the lake may form a single synclinal fold, overthrown to the eastward, of which the belt of green schists marks the axis.

Beyond the "Spokane" mine considerable intervals occur in which no rock exposures are seen near the trail, but the rocks appear to consist almost entirely, for a width of 2,800 feet across the strike, of greenish schists, which, though fine-grained, are often distinctly hornblendic in character. The angles of dip observed are nearly uniform, and it is probable that the thickness of these schistose beds is here about 2,350 feet. One bed of hard grey, somewhat schistose and slightly micaceous quartzite, of forty or fifty feet in thickness, was noticed in this schist series not far west of the "Spokane" mine. Another rock of peculiar character was found near the upper part of this series of schists, possibly forming its upward termination and immediately underlying the limestones next above. This is a grey, rather fine-grained schistose conglomerate, of which the schistose surfaces are often highly micaceous, and in which numerous small garnets occur. This entire series of schists, though not distinctly separable into greenish and greyish members, and though more highly altered and much less in thickness than those of the Adams Lake series in its typical locality, is supposed to represent that series.

Overlying these generally green schists is an important bed of limestone, the upper and western line of which is found on the trail at Cooper's cabin. It occupies a width, measured across the strike, of 600 feet, and has a possible thickness of 530 feet, though from its massive character and the crumpled appearance in some small exposures where bedding can be seen, this is very uncertain. It is chiefly grey and fine-grained, though occasionally marble-like. This limestone, together with the rocks overlying it, and forming the whole upper part of the Hot Springs section, are supposed to represent series No. 5 of the Adams Lake section, though the considerable volume of greyish schists found between the limestone and that at the "Number One" is not precisely parallel on Adam's Lake.

The section between Cooper's cabin and the "Number One" mine is very imperfectly exposed, but the rocks met with are chiefly greyish schists, often rather micaceous (though quite different in appearance from the mica-schists of the lake shore), with one or more rather important belts of black glossy argillites. Micaceous quartzite-schist occurs among the grey schists in places.

The width occupied by these rocks, measured across the strike from the line of Cooper's cabin to that of the "Number One" mine, is about 2,900 feet, and the thickness of rocks represented may be about 2,600 feet.

In the vicinity of the "Number One" mine, limestone is again found, and is supposed to represent a second and higher zone of this rock. It is conjectured that this may occupy the centre of a synclinal fold, the eastern side of which is regular and rather wide. The disturbed and often vertical black argillite-schist near the "Sky Line" in the vicinity of the edge of the bordering granite to the west, may represent the return on the west side of the synclinal of the similar rocks alluded to in the foregoing paragraph. It would, however, require much detailed examination to fully work out the structure of this section.

That a considerable amount of importance attaches to the arrangement of the various rocks comprised in the section at Hot Springs, is evident from the observed dependence in character of the ore deposits on that of the country-rock. The general direction of the veins is nearly north and south, being nearly or in some cases exactly parallel with the strike of the rocks. Some of these, like the "Spokane," appear to dip also at the same angle with the enclosing beds, but in other cases, to the west of this, the metalliferous veins cut across the bedding of the rocks to a greater or less extent, and may be expected to change in character when followed in depth into country-rock of another kind. The number of well defined veins which occur has not been yet ascertained. Some of the lodes are said to have been followed for several miles, but while it is evident that belts producing similar ore and exhibiting veins of like character and appearance have thus been traced out, it is not yet certain that any single vein runs continuously for such distance. This cannot, in fact, be certainly ascertained till much further work has been done. The lowest tier of deposits, included in the mica-schists of the Schuswap series, may be stated to yield ore averaging from 20 to 40 ounces of silver to the ton, while further up, selected ore in lots of several tons, has yielded from 85 to 300 ounces to the ton, the richest deposits being those associated with the limestone and black argillites.

The ore is principally argentiferous galena, which, in the lower veins contained in the harder rocks, has usually become decomposed to a very limited depth only from the surface; but in the limestones the decomposition has often extended to a considerable depth, and has resulted in the production of soft, rusty "carbonate ores;" filiform native silver or "wire silver," together with tetrahedrite are also found in some of these richer deposits. The veins which, like the "Spokane," follow the bedding of the mica-schists, are the most regular, while, as might be anticipated, those contained in the limestones are not nearly so uniform in size, and tend apparently to assume the character of mineral-impregnated belts of rock in which occasional large masses or "chimneys" occur. This is apparent in claims such as the "Sunshine" and "Number One." In the latter, where most work has been done, there is comparatively little true gangue associated with the ore, but zones of the limestone itself have become shattered and more or less highly charged with ore throughout. The ore even penetrates the limestone itself in the vicinity of the main deposits, and thin plates of native silver are found in joints, particularly in those parts of the rock which immediately overlie the larger masses of rich ore.

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[*] Report of Progress Geological Survey.

[†] The bearings given in this and following pages are magnetic, it being supposed that such compass bearings may prove more serviceable to the miners and prospectors than true bearings. The magnetic declination here is about 24° E.

The importance of the Hot Springs vicinity as a producer of silver and lead may, I believe, be stated to be assured by the number of deposits already known, and by the richness in silver of the ores from many of these which have been partially developed. Should only a small proportion of the numerous claims prove eventually to be as valuable as many of them now appear to be, the output of ore cannot fail to become very considerable within a few years.

The following notes relate to such of the claims as I was able to inspect personally last June. While those include several of the best known and most promising properties, numerous others are not mentioned, as it was impossible to visit all in the time at my disposal. The notes here given may, however, serve to afford some information as to the general mode of occurrence of the ores. The claims first described are those met with on or near the main trail, in order of ascent from the lake, and ending with the "Sky Line." After these, some claims to the south of the main trail are noted. A considerable group of claims situated some distance to the north of the main trail, including the Gallagher and others, was not visited by me.

Jeff Davis' Claim.—Height above lake, 690 ft.[*] Very little work has been done upon this deposit, which, at the surface appears to consist of an irregular shattered belt of rock, silicified and charged with ore, rather than a well-defined vein. Veins running through this contain galena in considerable quantity, in some places with a width of six inches of nearly pure ore. The ore is considerably decomposed at the surface, but is occasionally found to include a little copper-pyrites. This claim was first taken up in 1883 and has since been re-located several times. Several other claims, supposed to cover extensions of the same deposit, have been staked to the north and to the south.

Spokane Mine.—Height above lake, 1120 feet. This is situated on a very well defined vein, which runs between the beds of a medium-grained grey, silvery mica-schist. The course of the vein is the same as the strike of the beds, or N. 43° W. It dips to the south-westward at an angle of about 60°. The vein, as seen on the surface, is from one to two feet in thickness and is largely composed of galena, associated with a little iron-pyrites and quartzose gangue. A shaft has been sunk to a limited depth on the vein, following its dip, and a good deal of exploratory work has been carried on. The shipments during 1889 amounted to 44 tons, which yielded at the rate of 35 ounces of silver to the ton. The following claims are supposed to be upon the continuation of the "Spokane" lode, and there is little doubt in this case, from the remarkable regularity of the deposit, that most of them are actually situated on the same lode. Claims to the southward: "Maestro," "Little Phil," "Black Diamond," "Little Donald," "Paymaster," and one or more in addition, of which the names were not ascertained. Claims to the northward: "Trinket," "Maple Leaf" and others beyond Cedar Creek, which, owing to the amount of cover in the valley of the creek, cannot be certainly traced into connection with the "Spokane."

Sunrise Claim.—Height above lake, 1,920 feet. The country rock is here limestone, forming the lower part of the important limestone belt already described. The ore deposit, so far as it has been exposed by surface work, appears to be rather irregular in character, the ore reticulating through the limestone for a width of 20 feet or more, where best exposed. The direction of the general run of the ore at this place appears to be from N. 20° W. to N. 30° W., or nearly transverse to the strike of the rocks, which, however, turns more to the westward a short distance further north. A considerable body of ore is seen on the "Sunrise," most of it rusty and decomposed, forming the so-called "carbonate ore." This, however, contains numerous irregular masses of unaltered coarse-grained galena, which holds also a little iron-pyrites. To the southward along the strike of the rocks, the "Coronation" and "Black Chief" claims, with several others, have been taken up. To the north are the "Ohio," "Sweden" and a number of other claims.

Sweden Claim.—This is situated about 1,200 feet northward from the last-described, the "Ohio" claim intervening. A shaft has been sunk here to a depth of 40 feet, in which the width of the vein is stated to average 3 feet. The upper part of the deposit is completely decomposed, forming a soft, rusty mass of carbonate ore. From the shaft unaltered ore consists of galena, with zinc-blende and some iron-pyrites. The gangue is calcite, with a little quartz.

Tiger Claim.—Height above lake, 1,790 feet. This lies still further to the northward, on the edge of the wide valley of Cedar Creek. It is spoken of as being on the continuation of the last deposit, but the connection is not definitely traced. The vein here follows the bedding of the rock, running N. 65° W., with a southerly dip of 60°. The vein is overlain by rather fine-grained, grey, micaceous schists, and underlain by limestone, and appears to be about 3 feet wide. The ore is considerably decomposed and resembles that of the "Sweden," consisting of coarse crystalline galena, with some iron- and copper-pyrites.

Number One Mine.—Height above lake (at shaft), 2,510 feet. More development work has been carried out on this claim than on any other at Hot Springs. During the past year (1889) it is stated that 130 tons of selected ore has been shipped, the return in silver being at the rate of 85 ounces to the ton. Several substantial houses have been erected and other improvements made. A shaft had been sunk on the ore to a certain depth, at the time of my visit, and an adit run in for the purpose of intersecting the shaft, but I am unable to state what progress has been made in these workings up to date. The ore occurs in grey limestone, which is often rather shaly, and just above the shaft glossy black argillites are seen in the hill. The deposit appears to be somewhat irregular and "pockety" in character, as is usually the case in limestone country-rock. Its general run is supposed to be about N. 15° W., and ore, presumably representing a continuation of the same deposit, has been uncovered at several places, extending for a length of about 400 feet. At the surface the ore is completely decomposed, forming a soft, rusty mass, which is excavated by pick and shovel. In depth it is found to consist of galena and blende, with a little iron- and copper-pyrites. Native (wire) silver is not infrequent, and it is probable that some tetrahedrite or ruby-silver ore also occurs minutely disseminated. The metalliferous constituents of the ore are usually disseminated in small crystalline aggregations, the gangue consisting of more or less altered and silicified limestone and sometimes of quartz. Many little cavities lined with quartz crystals are found in the mass, and in some instances the metalliferous minerals penetrate the limestone irregularly for considerable distances. The mode of occurrence of the ore at this place and elsewhere in the limestone country, is such as to suggest that systematic exploration with the diamond drill will in future prove to be of essential service in tracing out and exploring for the more important deposits. Claims upon which ore has been found and which are supposed to cover portions of the northern continuation of the "Number One" deposit are, the "Columbia," "G. B. Wright," "Black Bear," "Della" and "Kate."

Della Claim.—This is the only one of the claims just enumerated which was visited. It is situated at a distance of nearly a mile in a north-westward direction from the "Number One," at an elevation of 2,490 feet above the lake. From the "Della" sixteen tons of ore is stated to have been shipped during the past season, yielding about 105 ounces of silver to the ton. An opening about fourteen feet in depth had been made on the out-crop at the time of my visit, but the vicinity is so much covered by soil and undergrowth that little could be seen of the relations of the ore. Black, glossy argillites, however, out-crop on the up-hill side of the ore, which is evidently in considerable body, though its width could not be ascertained. Where excavated it is almost completely decomposed, and resembles the upper part of the "Number One" deposit, but contains more galena in proportion. Some iron-pyrites was also seen.

Sky Line.—This claim is situated nearly a mile from the "Number One," in a direction about S. 30° W., and at a considerably greater elevation, being approximately 3,460 feet above the lake. It was discovered just about the time I reached Hot Springs, and it so happened that I was unable to find the point at which it had been uncovered. Specimens of the ore obtained at the surface consisted of rather fine-grained, grey siliceous rock, which had become porous from the weathering-out of its metalliferous constituents, but had no rusty appearance. In an unaltered state the ore might probably resemble some of the more siliceous portions of the "Number One." Under date January 24, 1890, Mr. J. Anderson informs me that a shaft has been sunk on this deposit to a depth of 100 feet where the ore appears to be unaffected by surface action, and shows more galena. It also occasionally holds native silver, and some copper pyrites with a sulphuret of silver or tetrahedrite. This claim is situated close to the eastern edge of the granite, which bounds the mining field to the west. An experimental shipment of 12 tons of ore has yielded about 300 ounces of silver to the ton. The ore is said to occur at the junction of argillite and limestone, the argillite forming the hanging wall.

The following claims, situated to the south of the main trail, were visited.

Little Donald.—Height above lake, 1,120 feet. This has already been alluded to as being on the southern extension of the "Spokane" vein. It is distant about a mile from the "Spokane" mine. The country-rock is mica-schist, dipping S. 70° W. < 45°. The vein here dips at an angle of about 40° and an incline had been run down on it for about 50 feet, with a drift to the north of about 40 feet at the date of my visit. The shaft was full of water at the time, but was afterwards cleared and carried down to 75 or 100 feet, when the quantity of water coming in led to the temporary suspension of operations. The vein is reputed to average from 6 to 9 feet in thickness. The ore consists chiefly of galena in coarsely crystallized form, and is not decomposed far from the surface. The gangue is chiefly calcite and dolomite, and the fact that very high assays are occasionally obtained indicates that some of the richer silver ores, such as tetrahedrite or argentite, are present in places. During the summer of 1889, 66 tons were shipped, yielding 95 ounces of silver to the ton

Krao Claim.—Height above lake, 1,390 feet. Some shipments were here first made of ore obtained from cavities in limestone, which constitutes the country-rock. These were said to run high in silver. After going down about 40 feet at this place, a second opening was begun at about 150 feet from the first, where the vein was better defined. A shaft was begun near the vein and was down about 20 feet last June. It has since, I believe, been carried to a depth of 75 feet. The vein appeared near the surface to be from 6 to 8 feet wide, but with rather irregular walls The limestone has the appearance here of a greyish or bluish marble, and dips S. 6° W. < 80°, which the vein also appears to follow. The ore consists chiefly of rather massive, coarsely-crystalline galena, more or less decomposed, but occasionally finds of native silver are reported. During the season eleven tons of ore was shipped, yielding at the rate of 90 ounces to the ton. Several claims supposed to cover the southern continuation of the same lode as far as Coffee Creek, or for a distance estimated at 7,500 feet, are said to show well in ore. These are the "Crow Fledgling," "Now Then," "Crescent" and "Eden."

United Claim.—Height above lake, 1,500 feet; situated about 1,500 feet to the north-west of the "Krao." This was a new discovery at the time of my visit, and had been uncovered for about 50 feet only. The foot wall which was exposed consists of greenish schist, dipping south-westward at an angle of about 40°, and the vein appeared to be parallel to its bedding. Its thickness, as uncovered, was from 3 to 5 feet. Part of the ore consists of coarsely-crystallized galena, part of very fine-grained galena.

Arkansas Claim.—An opening known by this name has been made in this vicinity on what appears to be a considerable deposit. There is a good showing of galena and rusty vein matter.

Black Chief.—Height above lake, 1,690 feet. Small prospect holes only had been opened upon this deposit, showing galena and rusty vein matter with much quartz. The dip of the vein is about S. 78° W. < 20°. Pure galena is said to assay 46 ounces of silver to the ton,

As previously stated, a great many claims upon which more or less ore has actually been found were not visited by me. Of these, one of the most important is that known as the "Gallagher," to the north of Cedar Creek, from which during the past summer, thirteen tons of ore was shipped, which is reported as yielding 126 ounces of silver to the ton. This is one of a considerable group of claims in the same vicinity. The notes given above, while incomplete, may serve to give some idea of this new district. The various claims in the present incipient stages of the work, change more or less in relative importance and appearance every month, as the work of development goes on, and thus render very minute description or enumeration of little practical importance.

Hendryx Mining Camp.

The peninsula on the east side of Kootenai Lake, nearly opposite Hot Springs, has become known as Hendryx, from the name of the very energetic manager of the Kootenai Milling and Smelting Co., by which company most of the work so far done here has been carried out. The rocks here met with have already been described as belonging to the lower part of the mica-schist series, or Shuswap group of the general section. The ore is comparatively low grade as regards silver, and will probably require the erection of smelting works on the spot before it can be profitably utilized. Its profitable shipment under the present conditions is quite out of the question.

The deposits of galena at this place are said to have been discovered by the botanist Douglas, as long ago as 1825. In later years they have been taken up and abandoned several times, the country being too remote for their utilization or development.

The ore deposit, though, as above stated, low in content of silver—assays giving from 15 to 40 ounces to the ton only—is very large and striking in appearance. It seems to run in a general north and south direction through the entire length of the little peninsula, and is covered by three claims, known from south to north as the "Kootenai Chief," "Blue-bell" and "Comfort." The lode is shown at intervals, partly in natural exposures and in part in strippings, through all three claims, or for a total length of about 4,000 feet. Though varying much in appearance from place to place, and also in the upper and lower parts of the deposit, as seen in single exposures its general character is very similar in all. The ore consists of a mixture of iron and copper pyrites, galena and blende, contained in a quartzose gangue, which is often more or less cavernous and crystalline. Portions of considerable thickness occur throughout, which are almost pure galena, while in others iron pyrites preponderates, and these two minerals are usually associated in a finely or coarsely granular mass.

Though, generally speaking, very constant in its direction, the thickness of the lode appears to vary considerably. Thus on the southern point of the peninsular ("Kootenai Chief" claim) the main ore-mass has an average thickness, so far as can be seen, of about twelve feet; in a cross-cut made on the "Blue-bell" claim, the ore is reported to be about eighty-six feet thick, and from the material on the dump, must here consist chiefly of galena. In a general way, the lode closely follows the strike of the containing rocks, which consist of mica-schists, marble and quartzites. That the lode is not, however, always in strict parallelism to the bedding, is shown by the fact that the bed above it is in some places marble, in others mica-schist; also by the circumstance that parallel zones of ore occur at some distance from the main mass. It should be added, that while the general run of the ore appears to be persistent and continuous, as above stated, there are evidences of small displacements by faulting, while masses of marble or limestone also occur in it, and irregular spurs of ore were observed to run off, as though at times the ore had replaced parts of the adjacent marble.

At the south point of the peninsula, the ore and containing rocks dip S. 80° W. < 60°; at the "Blue-bell" openings, S. 73°, W. < 45°; and near the north end of the "Comfort" claim, S. 80°, West. < 20°. A considerable amount of prospecting and development work has been done on the "Blue-bell" claim, and an adit is now being run in from the vicinity of the lake shore with the object of tapping the vein at a considerable depth and affording a satisfactory beginning for regular work. This, at latest advices, had reached a length of over 300 feet. The work done in the "Kootenai Chief" and "Comfort" claims has been confined to stripping and surface trenching.

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[*] The heights assigned to this and other claims were barometrically determined with approximate accuracy.

Toad Mountain and Vicinity.

The greater number of the discoveries of metalliferous deposits made on Toad Mountain and in its vicinity, are included within the limits of an apparently isolated area of stratified rocks. This area runs nearly east and west, extending from the head of Cottonwood-Smith Creek, westward to the vicinity of the lower fall of the Kootenai River at Ward's Ferry. Its length, in the direction above indicated, is about eleven miles, while its average breadth may be about two miles. While, however, its northern boundary may be considered as being shown with approximate accuracy by the line on the map, its southern edge was not examined by me, but depends on statements received from others. The rocks surrounding this area are everywhere, so far as observed, grey granites.

The stratified rocks here met with differ considerably in appearance from those found in the vicinity of Hot Springs, but, as already mentioned it is supposed that they represent, for the most part, the greenish and grey schists of the Adams Lake series. The differences found between these rocks and their supposed representatives at Hot Springs is paralleled elsewhere in the province, and appear to depend chiefly on the greater amount of pressure and consequent crushing to which the rocks of the last-named locality have been subjected. It is principally to action of this kind that the markedly schistose character of the rocks of Hot Springs is attributed. The outlier constituting the stratified area of Toad Mountain, has apparently been more affected by heat and hydrothermal action consequent on the extrusion of the granite, and while schists resembling those of the grey and green series at Hot Springs are not wanting here, they are subordinate in importance. Connected with this difference in the mode of alteration of the rocks, rather than with any original diversity in the mineralogical composition of the country-rock, is no doubt the well-marked difference in the ores of the two places.

The rocks characteristic of this outlier, though presenting many varieties which will eventually be found worthy of more minute investigation, may be described as consisting for the most part of stratified volcanic materials of palæozoic age. These are generally of greenish or grey colour, and appear for the most part to be diabase in lithological composition. Diabase-porphyrite is not uncommon, and notwithstanding the considerable degree of metamorphism which the strata have suffered, some distinctly amygdaloidal diabases are still to be found. Hornblende-schists and rather massive pyroxinite-like rocks with some hornblende, also occur, especially in the immediate vicinity of the granite. When the rocks assume a distinctly schistose character, as in certain belts near the "Cottonwood" and "Silver King" mines, it is sometimes clearly apparent that the schistose structure does not entirely correspond with the original bedding, but crosses it at an angle. Near the western extremity of the stratified area, where the rocks are more closely surrounded by the granite than elsewhere, they are found to have suffered more than the usual amount of change. They consist of fine-grained gneissic, hornblendic and micaceous schists, often greenish in colour, owing to the development of epidote. Here also a thin bed of limestone converted to a coarsely crystalline marble was observed. In addition to the rocks of volcanic origin, beds of blackish argillite, more or less pure, were found in some places, but these hold a subordinate position in the series. The general direction of the strike of the rocks in this area is nearly parallel to the longer axis of the area itself, while the majority of the dips are in southward direction, usually at high angles or nearly vertical, though toward the west end decreasing to 40° or even to 20°.

Much altered fragments of the stratified rocks are frequently found enclosed in the mass of the granite near the line of junction. The granite near this line is also generally much jointed, and often greenish from the development of epidote, which is specially abundant along the jointage planes. The occurrence of this isolated area of stratified rocks, together with that of the smaller but similar mass on the east side of the Cottonwood-Smith-Creek, renders it probable that additional similar areas yet remain to be found elsewhere in the great granite region. Should such be discovered, they may prove to afford further deposits of ores like those of Toad Mountain. The following notes refer to the claims visited by me on Toad Mountain and in its vicinity last June. These comprise the principal properties upon which more or less work has been done:

Silver King Mine.—Height above lake (at houses), 4,310 feet. This property, sometimes known as the "Hall Brothers' Mine," is the most important so far known, and its discovery led directly to the recent interest and developments in this region. It was accidentally found late in the autumn of 1886, but nothing was done toward opening it up until the next spring. Toad Mountain, previously one among many undesignated summits, received its somewhat peculiar name at the same time. The mine is now reached by a fairly good, though often steep trail, the distance from Nelson being about five miles in a straight line. The property consists of three claims, each 1,500 feet in length. Of these, two, named the "Silver King" and "Kootanie Bonanza," are laid out along the run of the principal vein, the third, known as the "American Flag," lies alongside to the north, and is supposed to cover a second parallel vein.

In ascending the mountain by the trail, granite continues for some distance from Nelson, but is replaced by stratified rocks, previously described, probably near the point at which Give-out Creek is crossed by a bridge. Greenish diabases, both massive and schistose, are characteristic, but about quarter of a mile southward from the houses at the mine, these are followed by a grey decomposed quartz-porphyry, which, from its appearance and mode of fracture along jointage-planes, simulates granite when seen from a distance. The rocks in the immediate neighborhood of the openings made on the ore, are generally massive, though also in places schistose. They are here frequently more or less completely silicified and blotched by little segregations of quartz. On the slopes of the summit situated about a mile to the westward from the houses at the mine, some blackish argillite-like beds occur, and on this summit one of the distinctly amygdaloidal rocks previously alluded to was found. Lithologically this rock is a diabase-porphyrite.

The rocks are generally highly inclined or vertical, and their strike is nearly parallel to that of the schistose lamination, so that it is difficult to determine whether the schistose zones have differed originally in composition, or whether they merely represent lines along which the rocks have yielded to crushing. The general run of the metalliferous veins is also here nearly, though probably not exactly, parallel to the strike of the rocks.

The greater part of the work accomplished has been carried out on the "Silver King" claim, for an opportunity to examine the openings on which and other facilities I was indebted to Mr. J. Macdonald and Mr. Hall.

The lode, or ore-body, has been traced more or less continuously through the "Silver King" and "Kootanie Bonanza" claims, with a general direction nearly east and west magnetic. While, however, the general continuity of the ore-bearing zone has thus been proved, it appeared to me probable, on comparing the positions of the various openings, that its run is not throughout perfectly straight. On the "Silver King" claim houses have been built, and two drifts have been run in at different levels on the lode. From the end of the upper drift, the ore had been followed down by a winze to a depth of thirty feet at the time of my visit. This is stated since to have been continued to fifty feet, at which depth it is reported to be in a large body of rich ore.

The best opportunity of examining into the character of the deposit occurs in these workings. The lode is found to possess no distinct walls, but to occur as a zone of variable, and sometimes apparently of indefinite width, of shattered and mineralized rock, throughout which veins of pure and richly argentiferous ore occur in a somewhat irregular manner. Where gangue appears it is principally quartz, but there is on the whole a rather notable absence of gangue, or crystallized vein material, the ore apparently filling irregular crevices, and running in shoots and spurs into the rock, so as to form here and there considerable masses. The metalliferous minerals comprise bornite and tetrehedrite, with some iron and copper pyrites, but only occasional traces of galena. The two first mentioned minerals, when nearly pure, contain the largest percentage of silver, while the pyrites is comparatively poor. In surface exposures the material of the lode is almost completely oxidised, producing a brown or blackish gossany material with some green and blue carbonates of copper.

The excavations so far made are of a very irregular character, the ore having been followed wherever it appeared, and in some cases a considerable quantity of barren rock has been dealt with in pursuing this method of work, which can be justified only because of the great richness of the ore and the want of sufficient capital for more systematic operations. All the circumstances appeared to me to warrant the expenditure of a large sum of money, if necessary, in order to define and open out this remarkable deposit in a proper manner, and till work of this kind has been done, it will be impossible to ensure any large or continuous output of ore. The richer portions of the ore are at present selected by cobbing and and hand-picking, and packed in sacks for shipment; but a considerable portion of the whole is thrown to one side, pending the erection of machinery for fine concentration. According to the Report of the Minister of Mines of British Columbia for 1889, the cost of conveying the rich ore on pack mules from the mine to Nelson, was $10 per ton, and from Nelson to Butte, Montana (a distance of 700 miles), including the charge for smelting, cost a further sum of about $47.

The character of the ore obtained is shown by the following analyses by Messrs. Johnson & Matthy, London, for which I am indebted to Mr. R. D. Atkins, who collected the three specimens referred to:

	I.	II.	III.
Copper....	47·000	24·900	40·100
Silver............	2.360	·232	1·292
Iron................	7·300	12·200	1·800
Zinc................	1·300	2·400	5·700
Manganese..........	1·200	5·100	·400
Antimony...........	1·400	3·400	15·600
Cobalt and Nickel....	traces.	traces.	traces.
Lead	·100	traces.	1·700
Arsenic	3·100	2·100	4·500
Carbonic Acid.......	nil.	6·000	nil.
Lime.........	nil.	5·200	nil.
Magnesia.......	·700	traces.	nil.
Alumina	nil.	·200	nil.
Sulphur.............	22·900	22·000	27·200
Phosphorus	nil.	traces.	nil.
Siliceous insoluble matter..............	9·200	8·800	1·000
Traces of gold, oxygen, water and loss ...	3·440	7·468	·708

to the ton of 2,240 lbs., specimen No. 1 contains 771 ounces of silver; No. 2, 75 ounces 16 dwt; No. 3, 422 ounces. Traces of gold were found in all, and in two shipments made to smelter, of which details have been obtained, the value of the gold recovered per ton of 2,000 lbs., amounted to $2.16 and $1.44 respectively.

The ore where exposed on the "Kootanie Bonanza," to the east of the "Silver King," and at a height of about 200 feet above the level of the lower drift on that claim, is similar in appearance to that of the "Silver King," but more or less superficially decomposed. What is known as the "Grizzly" claim, lies parallel to the "Kootanie Bonanza," adjoining it to the north. This is not a part of the Hall Brothers' property. An opening made to a small depth in one place, again shows similar ore in a shattered zone of country-rock. The "American Flag" claim was not visited.

A small opening made at the side of the main trail a short distance below the houses on the "Silver King" and at the west end of that claim, deserves some notice. This, according to Mr. Macdonald, is precisely on the line of the main lode, and is considered to represent its continuation at a lower level. The lode is here much more regular in character than where it has been worked, being enclosed by schistose rocks, the strike of which it follows. It is from three to four feet in width, and contains a considerable proportion of galena, approaching in character and appearance the deposits found on the "Iroquois" and "Dandy" claims, subsequently noticed. On the assumption that this actually represents the continuation of the "Silver King" lode, it is evident that that deposit must change in its character to the westward or in depth, and it seems probable that such change occurs together with that in the nature of the country-rock, the hard, massive, irregularly shattered rocks found in the drifts appearing to yield the richest ore. The shipments from the "Silver King" during the past season are reported to have aggregated sixty tons, averaging about 300 ounces of silver to the ton.

Dandy Claim.—Height above lake (at entrance to drift), 3,980 feet, or about 300 feet below the houses of the "Silver King." This claim lies to the west of the "Silver King" claim, adjoining it, and there can be little doubt that it is located on the continuation of the same lode, which has been exposed at various places throughout the length of the claim. Comparatively little work beyond this tracing of the lode had been done at the time of my visit. The lode runs nearly east and west magnetic, showing, where a drift had been begun, a dip at an angle of about 80° to the southward and a width of three feet. The ore consists principally of galena, with copper-pyrites and occasionally some blende. It shows besides occasional stringers of tetrahedrite, which are reported to yield very high assays. The gangue consists of quartz, which is present in larger quantities than in the "Silver King" ore. The wall rocks are composed of green slates or schistose diabases, the strike of which the vein follows exactly. It holds its width well where exposed, and appears to be fairly regular in direction and character. No ore rich enough to ship under present circumstances has yet been obtained from this property, which nevertheless promises well, and appears capable of yielding, with fine concentration, a large proportion of rich ore.

Iroquois Claim.—Height above lake (at entrance to drift), 4,190 feet. This claim lies to the south of the run of the "Silver King" lode, and is supposed to cover a distinct deposit. The vein here runs about S. 80° E. and has been traced by trenching at intervals through the whole length of the claim, or for a distance of about 1,500 feet. The country-rock is a grey, rusty or green-grey schist, probably a diabase schist, but so much decomposed in some places that it is difficult to characterize it. A drift about sixty feet in length had been run in along the lode at the time of my visit. The lode is practically vertical, with a width in some places of twelve feet of ore or mineralized rock. It is stated to be not less than six feet in width in any place where it has been exposed. The ore somewhat resembles that of "Silver King," but contains more galena, and is more diffused through the gangue and the country-rock where exposed in the working. It also contains copper and iron pyrites, together with some tetrahedrite, the last mentioned mineral being the richest in silver. Crystalline quartz, which often occurs in nearly pure masses of some size, is much more abundant than in the "Silver King" workings. This is another very promising deposit, but like the "Dandy," yields no ore rich enough for present shipment.

The group of claims to which the above description refers, including those of the Hall Brothers, are contiguous, and are comprised in a comparatively small area on and near the sources of Give-out Creek. Here the discoveries and work already accomplished are such as to ensure a large output of rich, or rich and medium grade, silver ores, and the combination of the interests thus included within a length of less than a mile from east to west, would appear to justify the immediate initiation of some more efficient system of transport to the shore of the lake than that afforded by the present trail. While a waggon road with moderate grades might, I believe, be constructed from Nelson, the cost would be great, and the late date at which snow lies at the considerable altitude of these claims, as compared with that at which it entirely disappears from the lower levels, would be a drawback. The transport of ore down the steep grades of the upper part of the mountain might be arranged for, however, by a tramway to a point lower in the valley of Give-out Creek, or an aërial wire tramway might without difficulty be constructed. Some such means of conveying the ores, together with the capital necessary for the systematic opening up of the deposits and the introduction of machinery for the fine concentration of the second quality of ore, are the most pressing needs of this locality. No very important further developments need be expected till some such facilities are available, except, indeed, in the case of the richer portions of the "Silver King" lode, which may continue for some time to yield sufficient high grade ore to pay for its working on the present comparatively ineffective system.

Cottonwood Mine.—Height above lake, 2,835 feet. This is situated at the extreme east end of Toad Mountain, on the summit of a spur which lies between the source of Cottonwood-Smith Creek and a small western feeder of that stream. A good trail has been constructed from Nelson to this property, which consists of three claims placed end to end on the length of the deposit, and a fourth claim lying alongside. The deposit consists essentially of a belt of pyritized schists holding gold. The rocks of the stratified series seen a short distance to the north of the deposit, and near their junction with the granite, are diabases and diabase-schists of the usual kind, and include diabase porphyrite precisely like that previously described. In the immediate vicinity of the metalliferous belt, the rocks are chiefly schistose diabase, and the belt itself consists of similar rocks, which here and there include lenticular areas of massive diabase, together with some almost nacreous pale-grey and whitish schists. In what I have spoken of as the metalliferous belt, all these rocks are more or less completely though irregularly silicified, and charged with granular iron-pyrites, with here and there a little copper-pyrites and specks of galena. These pyritized schists are further seamed in all directions by little veins and stringers of quartz, holding the same minerals, but chiefly iron-pyrites. The entire superficial portion of this metalliferous belt of rock has been more or less completely oxidized to a depth varying from a couple of feet to ten, twenty or more feet. The decomposition of the rock is usually so complete that it may be removed easily with the pick and shovel. Some portions of the little quartz veins traversing the rocks, present in the decomposed mass an almost scoriaceous appearance, due to the removal of the iron-pyrites, and occasionally the whole of the iron-oxide produced in this process, has subsequently been leached out, leaving porous masses of white quartz. The iron oxide thus removed has elsewhere been deposited in fissures and hollows in the form of bog-iron ore.

The metalliferous belt is said to be continuously traceable throughout the length of the three claims above alluded to, and in the vicinity of the present workings must have a width of at least 300 feet. The average dip of the schists at this place is about S. 12° E. < 80°, and this is probably followed by the metalliferous zone. The assay value of the metalliferous material appears to vary considerably, and I am not in possession of such information as to be able to state what might be taken as a fair average. For the purpose of working the superficially decomposed portions of the deposit, two Huntington mills, with a capacity of 12½ tons, have been erected, and the necessary houses, ore-shoots, etc., constructed. But a small quantity of the material has, however, as yet been milled. Should the results prove satisfactory, the quantity of pyritized material which may eventually be treated by concentration and chlorination appears to be practically unlimited, and in consequence of the facility with which it may be handled and worked, a comparatively small average yield in gold would be sufficient to justify work on a large scale.

Umatilla and Uncle Sam Claims.—Height above lake (at cabin), 1,280 feet. These claims are situated on the east side of Cottonwood-Smith Creek, about two miles and a half from Nelson. Together with a third claim called "The Apex," these are generally known as the "Labeau Mines." They occur in an outlier of the diabase series, the extent of which to the eastward was not ascertained. The vein opened on the two first-mentioned claims, is stated to be continuously traceable for a considerable distance, and to average about two feet in width. Where I saw this vein, at a point at which a small shaft has been sunk on it, it runs N. 20° W., and is nearly vertical, or dipping at an angle of about 80° to the eastward. The eastern or hanging wall is here formed by a dyke of grey granite five or more feet in width. The foot wall is not well defined, the ore blending irregularly with the diabase rock on that side. The vein covered by the "Apex" claim is stated to run nearly east and west.

The character of the ore obtained from this group of claims differs considerably from that elsewhere seen in the district. The quartz gangue is hard and vitreous and more or less charged with green chloritic minerals. The metalliferous constituents are fine-grained, and consist chiefly of galena and an intimate mixture of galena and blende. Tetrahedrite, or some such richly argentiferous mineral, probably also occurs in small quantity, irregularly disseminated.

Tough Nut Mine.—This is situated on the northern slope of Toad Mountain, at the head of Sandy Creek, and about two miles in a north-westward direction from the "Silver King." The vein here opened appears well defined. It runs S. 70° E., and is nearly vertical, the width of the ore-bearing part of the vein being, where seen, about four feet and a-half. The vein has been exposed at intervals throughout the length of the claim of 1,500 feet, and is seen on the summit of the ridge to the eastward on an adjoining claim known as the "Evening Tide." The ore contains galena, with iron- and copper-pyrites, zinc-blende and tetrahedrite, the last-named mineral being, as usual, the richest in silver. Crystalline quartz is moderately abundant, but a considerable part of the gangue is made up of dolomite and shattered and mineralized rock matter. The adjacent country-rock consists of green schists of the usual character. The vein is well situated for working by means of drifts, as the hillside up which it runs is very steep and over 900 feet in height. The work done at the time of my visit, besides surface stripping, included a drift about 100 feet in length on the vein, and a shaft 30 feet deep, at a distance of 440 feet from the mouth of the drift, and about 160 feet higher on the hill. Several other claims have been taken up in this vicinity, but with the exception of the "Tough Nut," little or nothing has been done toward their development.

Poorman Mine.—This is one of several claims belonging to the Eagle Creek Gold Mining Company, but on this only has any considerable work of development been accomplished. These claims, with several others in different hands, are situated about four miles west of Nelson, and the point at which most work has been done is about half a mile south of the main trail from Nelson to Sproat's Landing, on the east side of Eagle Creek. The deposits of this locality differ from all those previously described, in being situated beyond the area of the stratified rocks, the country-rock here being a dark grey, mica-syenite of granitic appearance, and referable to the granites of the second period of irruption, as already noted. This, as already mentioned, is an interesting point, as showing that the granitoid rocks may, under certain circumstances, also prove to be metalliferous.

The lode opened up on the "Poorman Claim" runs about S. 60° E., with a northerly dip at an angle of 50° to 60°. It averages about 18 inches in width, and seems regular and fairly constant in this respect. The gangue consists of glassy or milky quartz, and contains copper- and iron-pyrites, distributed throughout in stringers and small bunches. The gold is contained in these sulphurets, and the average value in gold, per ton of the ore, is stated at $30. At the date of my visit an adit had been run in to the vein, intersecting it at a depth of about 95 feet from the out-crop, and since that time further work has been done, and a ten-stamp mill, with concentrators and other machinery, has been placed on the ground ready for erection in the spring.

Other Metalliferous Deposits.

Though scarcely recognized as belonging to the Toad Mountain region proper, the deposits on Eagle Creek are really on the northern slope of the mountain-mass thus named. A few outlying localities in this vicinity and elsewhere in the district, in which minerals of economic value are known to occur, may now be alluded to.

Copper Queen.—This name is applied to a discovery situated on the north side of the Kootanie River, about a mile above the mouth of Forty-nine Creek. I was unable to visit this claim, which is described as an irregular deposit of great size. Specimens received from it, however, show the ore to consist chiefly of massive copper-pyrites. Though reported to contain a considerable proportion of silver, specimens of this ore subjected to examination in the laboratory of the Survey proved to contain only 1·4 ounce of silver to the ton, with traces of gold.

Iron Ore near the Lower Fall.—About half a mile below the lower fall of the Kootanie River, on the north bank, and near the water's edge, is a remarkable occurrence of magnetic iron ore. The ore is found in large, loose masses, weighing several tons, but owing to the want of good exposures its actual relations to the rocks adjacent could not be ascertained. The place of its occurrence is near, if not on, the line of junction of the granites with the here highly altered rocks of the stratified series. It appears to be associated with a dyke about 40 feet in width, of green-grey augite—porphyrite of somewhat peculiar appearance, which crumbles down easily under the action of the weather. It seems probable that the iron ore, when in situ may form large, irregular masses along the borders of this dyke. The ore is finely granular in texture and generally free from rock matter or other impurities, but in some places contains silicious kernels, with epidote and brown garnet. A fragment of the ore comprising one of these kernels, and rusty in appearance, was examined for gold and silver, but proved to contain neither.

On the north-east arm of Upper Arrow Lake, ten mining claims have been taken up, according to the report of the Minister of Mines for British Columbia. Good specimens of argentiferous galena ores have been brought from these claims, which, however, were not visited by me, and on which little work has yet been done.

Specimens from a quartz vein traversing the argillite-schists a short distance north of the mouth of Koos-Kanax Creek, on Upper Arrow Lake, proved, on assay in the laboratory of the Survey, to contain neither gold nor silver.

Some specimens of a peculiar vitreous quartz traversing the gneissic and mica-schist series at the north-west corner of Kootanie Lake, though showing a little galena, also proved to contain neither gold nor silver on assay.

The occurrence of tourmaline with some peculiarities in the appearance of the granites, already referred to as being characteristic in the vicinity of Fry River, on Kootanie Lake, led me to collect some of the heavier materials by washing the gravel of the river in a gold-pan, for the purpose of ascertaining whether any trace of tin could be found, but this also proved to be quite barren on analysis.

Petroleum Engines in Mines.

Mr. A. A. Atkinson, in the Journal of the British Society of Mining Students, describes the five horse power petroleum engine at the New Brancepeth colliery. It is placed at a distance of 2,400 yards from the shaft, and at a point 165 vertical feet to the dip. It is placed on a masonry pillar, which also carries the tank and other details. A heavy fly wheel is used, and the explosion takes place at every second stroke. The cylinder is cooled by water supplied by a ¾ inch pipe. The ignition spark is supplied by a single bichromate cell. The engine runs at 140 to 160 revolutions, and works a pump at 20 to 23 strokes per minute. A 6 inch double-acting pump with a stroke of 18 inches is used, and forces the water for 1,320 yards to a height of 72 feet above the suction end. Fifty gallons per minute are delivered when the engine runs at 170 revolutions. The exhaust from the engine is taken a distance of 33 yards from the engine, and issues at a temperature of 70° F. The most complete combustion takes place at higher speeds; when the speed is low the exhaust contains a large percentage of carbonic-oxide. This, however, is largely diluted by a good current of air which passes through the engine house. The cost for 10 hours is 10s. 8d., whilst the cost of working the pump from the tail rope of the haulage system is calculated at £1 14s. In this time 10 gallons of petroleum are used, or about $1\frac{3}{5}$ pint per horse power per hour. Regulations are given for controlling the working of the engine and the carriage and storing of petroleum.

Mr. H. B. Budgell also gives some notes on the working of two petroleum engines underground. One was situated near the bottom of the pit, where it had plenty of air, and gave satisfaction. The other was at the bottom of a long dip, where the air supply was imperfect and the water sometimes gained on the pump, so that it was working under considerable disadvantages. The exhaust from this latter had acted badly on the roof in the return airways. The first of these pumps deals with 100 gallons per minute for 10 hoars, and delivers it to a height of 100 feet through 250 yards of piping. The author then goes into the question of the work done and the cost, and shows that the work for the cost is about the same in both instances.

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Coal Separating and Washing Plant.

Detailed illustrations are given in *Engineering* of a Lührig coal-separating and washing plant. The plant treats 1,500 tons per day, the output of three pits, and consists of a dry separation or coal-washing plant proper, with means for dispensing with settling ponds by treating the water. Elevations, plans and sections of the plant are given. It consists of (1) a screening plant; (2) the coal-washing plant proper; (3) plant for handling automatically the finest material contained in the water used for the washing, to obviate the necessity for settling ponds; and (4) the loading plant. The whole process is designed to avoid breakage by rough handling of the coal, and to make the action as nearly as possible, automatic. The coal is brought in hutches by wire ropes, and is discharged by tumblers on to vibrating screens with 2 inch round holes. The lump coal passes on to the travelling belts, which are made of spaced round rods instead of plates. The dross from these picking belts and from the screens, is taken by an elevator to the washery.

The machinery in the dry separator house is driven by a separate engine, so that loading can go on continuously. The dross from the screens and belts is passed through revolving trommels, and all sizes above ⅝ inch pass to the jigs. The intermediate quality from these jigs is crushed and re-treated. The fine coal under $\frac{5}{16}$ inch in size, is treated in pyramidal separating boxes and felspar jigs. The dirty water is passed down along a trough against a slowly travelling creeper, which collects and removes the dirt as it settles.

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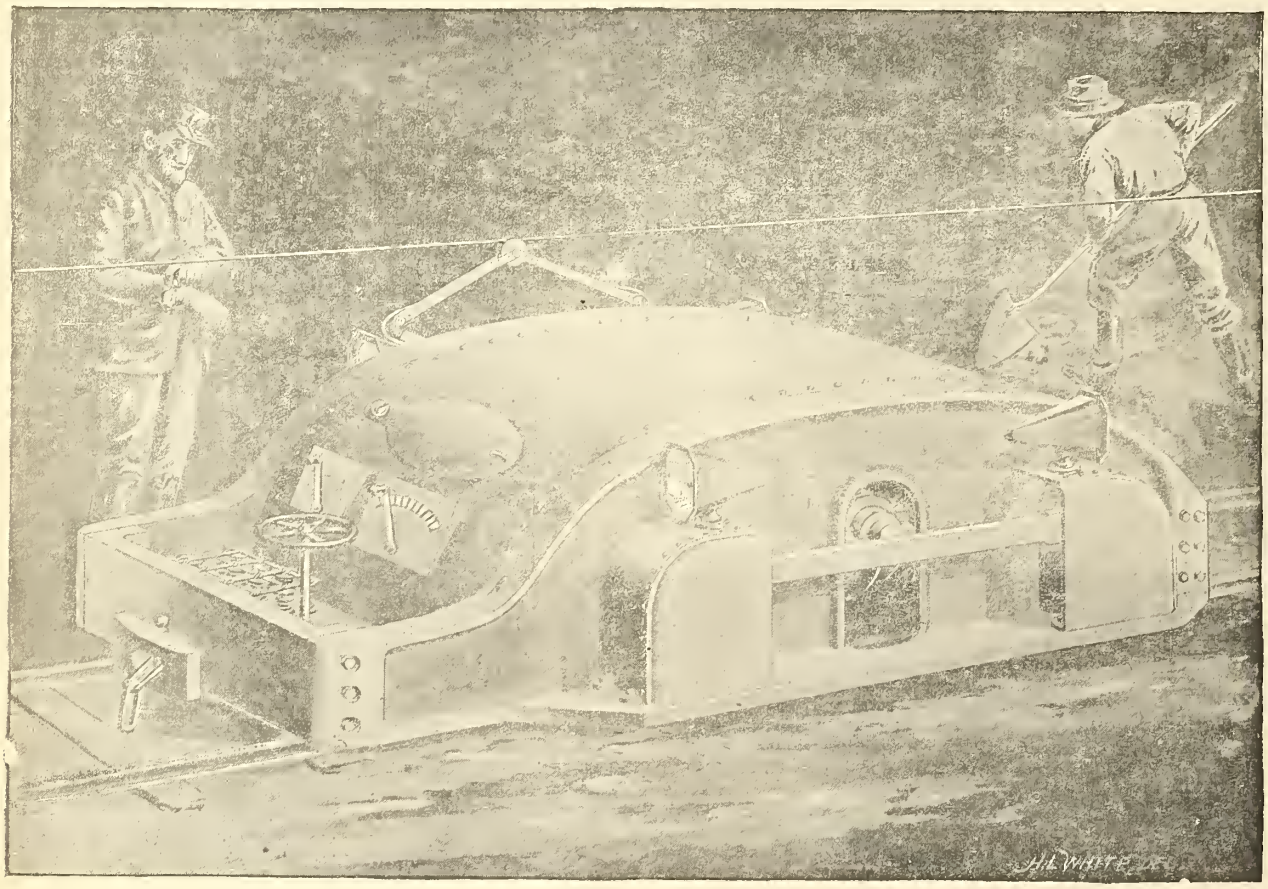
Economy of an Electric Mining Plant.—After briefly describing the Hercules mining machine Mr. C. F. Scott, in a paper read before the Engineers' Society of Western Pennsylvania, draws a comparison between hand labor and machine labor for coal mining. In machine mining the stalls can be made much wider, because of the great rapidity of mining, so that the roof will stand a shorter time with fewer pillars. The immediate effect of the introduction of coal-cutting machinery is to reduce the cost of undercutting from 20d. to 5d. per ton of 1½ inch coal in the Pennsylvania district. Taking into account the other expenses, there is saving of 25%. Another advantage of machine mining is that perfect pillars are left and can be recovered, as there is no temptation to rot them. The reduction of the number of stalls for the same output, due to machinery, also causes a great saving in the timber, the number of roads and the tramways that have to be kept up. The saving of coal due to the introduction of machinery, is also very great; this arises from the small amount of slack and the larger coal produced by the smaller height and greater depth of undercutting, and also from the pillars not being crushed. An estimate is given of the saving in expense by using a plant of seven machines, run ten hours a day, and cutting 233 tons. The cost is £29 11s. 3d., made up as follows: fuel, 9s. 7d.; wages, £2 10s.; deterioration of boiler, engine, electrical apparatus and wire, £1 6s.; cost of repairs, £1 8d.; cost of working, £4 17s.; loading and blasting, £19 8s. The indirect saving is estimated at £2 19s. The cost of hand mining is £38 6s. 8d. The saving by the use of machines is therefore considerable in all directions.

Electrical Mining Machinery.—The Exhibits at the recent Montreal Electrical Exhibition.

The Fourteenth Convention of the National Electric Light Association, held in Montreal last month, marks the beginning of a new era in electrical progress in the Dominion. Canada has fallen far to the rear of other countries in the application of electricity to mechanics, and though dynamos are now being installed almost daily, still their number is very far from what it should be. But the Convention has presented to Canadians a better idea of the great adaptability and economy of this factor than could have been obtained by years of theoretical teaching, and the consequence should be an immediate and greatly increased installation of electrical plants. The Victoria Rink, where the exhibition was held, was completely filled with all descriptions of machinery, arc and incandescent lights, and scientific instruments shown by the various great electrical firms; dynamos and motors developing from 75 H.P. to ⅙ H.P.; volt meters, ammeters, and delicate instruments used for chronological and other purposes in observatories; and lights of all kinds and colors everywhere, illuminating every nook and corner, and rendering the scene one of great brilliancy.



One of the principal exhibits in the rink, and the one certainly of great interest to mining men, was that of

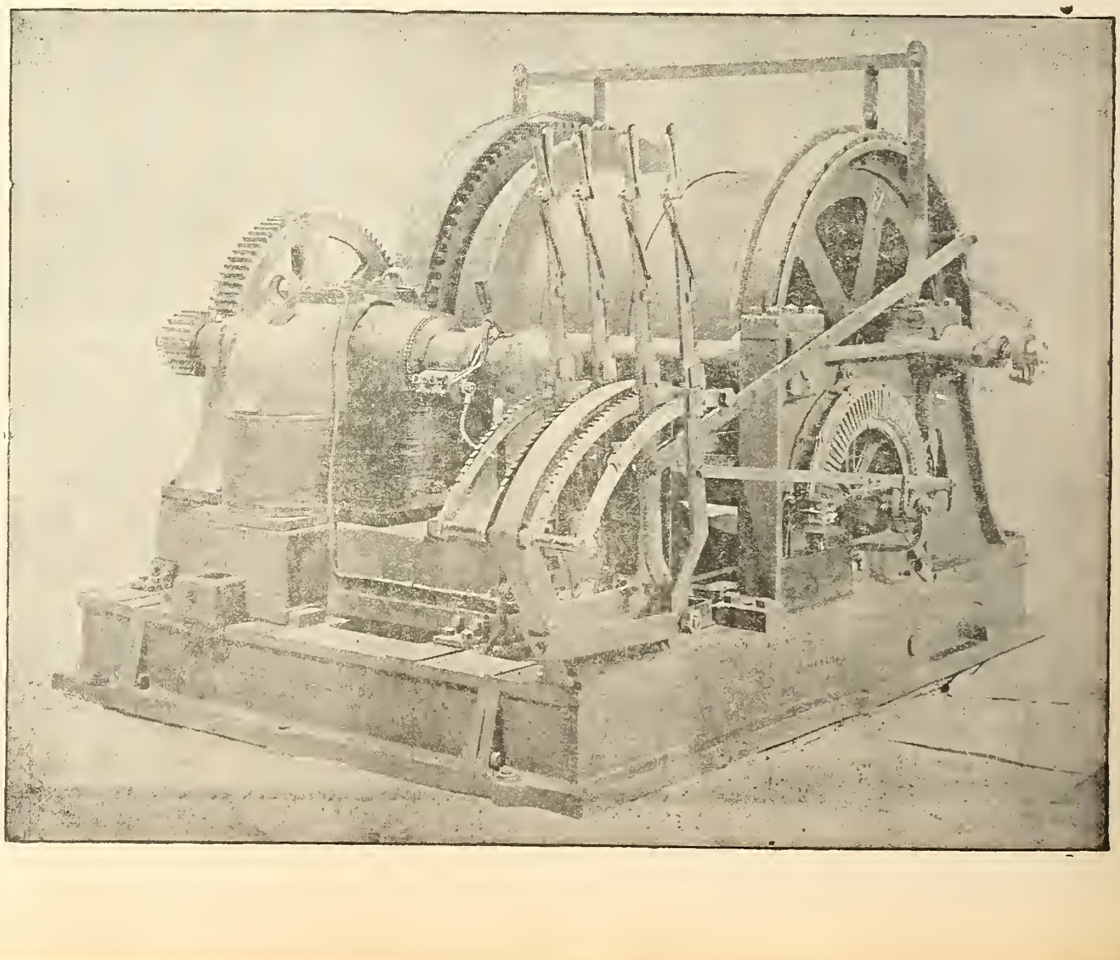
THE THOMSON-HOUSTON INTERNATIONAL ELECTRIC COMPANY,

of Boston, which occupied at least one-fourth of the spacious floor. Moreover, more fortunate than some others, they had secured power to run their plant, and all the machinery on view was at one time or another in operation. This power was obtained from the Mechanical Building of the McGill University, three-quarters of a mile distant, where a battery of Babcock and Wilcox boilers supplied steam to a 12½ x 12 McIntosh and Seymour engine, the two driving wheels of which belt directly to two 50 H.P. 500 volt generators of Thomson-Houston manufacture. These generators have both series and shunt windings, so proportioned as to ensure the delivery of electric current at a difference of potential of 500 volts at the rink, and the amount of supervision they require is reduced to a minimum by the self-oiling boxes and carbon brushes with which the dynamos are equipped. Six insulated wires—three positive and three negative—conveyed the current to the hall, with a loss of about 10%; or in other words, delivered 90% of the power given out by the dynamos.

Four electric motors were driven by the power thus generated and transmitted, of 75, 45, 15 and 10 H.P. respectively, and all designed to run at a constant speed, regardless of the amount of work required of them. Except that they were without series winding, they resembled closely the generating dynamos in every respect. Each one was supported upon an adjustable sliding base, by which the tension of its belt was adjusted, and these bases were in turn securely bolted to insulating wooden frames. Each motor was equipped with self-oiling boxes and radial carbon brushes. The largest motor, of a rated output of 75 H.P., drove by direct belt connections a 650 light alternating current dynamo and its exciter; the 45 H.P. motor operated similarly an excelsior arc light dynamo, which in turn furnished a curent for 30 arc lamps and one 10 H.P. constant current motor; the 15 H.P. motor was belted to a Type D-15 direct current 110 volt dynamo, which carried 100 16-C.P. incandescent lamps, and the 10 H.P. motor drove the special direct current machine with its revolving brush device, which operated the electric rock drill. Each motor was controlled at the switch board, where were situated a double-pole switch, two fuse cutouts, a current indicator, and a rheostat for each motor.

A feature of their exhibit was the tramway truck manufactured by the Robinson Radial Car Truck Company, of Boston. This truck is equipped with two Thomson-Houston single reduction railway motors of 15 H.P. each. It is designed particularly for electric service, and is so proportioned that 95% of the entire weight of the truck is borne by the driving axles, 5% only being supported by the middle axle. The truck is built altogether of steel, and has a peculiar feature in the radial action which gives it its name. The middle axle by a motion at right angles to the truck, turns the end axles about the king-pins and places them radial to the curves. This is the distinctive feature of the truck, and it has many advantages, making the truck particularly suitable for roads where the traffic is great, where long cars are required, and where curves and grades are numerous and severe. The motor is the latest production in electrical railway apparatus, and is meeting with almost universal application upon the electric railway systems of the United States. It is practically iron-clad, having two internal pole pieces of ample spread, carrying two field spools, which nearly surround the armature coils. The magnetic circuit is completed on the front end of the motor by the nose-plate, and on the back end by the frame on which are cast the iron boxes and arms which serve as a support for the armature shaft bearings. The armature is of the Gramme-ring type, which is admitted to be superior to other forms of winding, any coil on this armature being easily replaced without disturbing its fellows. The weight of the motors and truck exhibited was 9,600 lbs., and is suitable for lines where the grades do not exceed 10%.

What most attracted the eyes of mining men was the Van Depœle Electric Rock Drill, and whenever it was being operated a crowd very quickly gathered. This drill is the invention of Mr. Charles J. Van Depœle, and is the result of several years' study and experiment. The object sought was to do away with the many drawbacks and imperfections of the steam and compressed air drills, while still retaining their invaluable properties. The result is seen to be a machine closely resembling older forms of rock drills in external appearance—the only advantage which is at once apparent being the substitution of a simple insulated cable for an expensive and inefficient system of piping. But the advance is far greater than this; an iron casing enclosing three coils of insulated wire replaces a complicated piece of mechanism with vapor-tight bearings, joints and valves, which is so liable to breakage from rough handling that in some cases even as many as 50% of the steam or air drills for a mine or quarry are kept in the repair shop at all times. A solid iron core, and a copper shaft to which it is rigidly attached, form the moving portion of the machine. There are no commutating devices and no make-and-break of the electric circuit. A ratchet device in the head of the machine causes the drill rod to revolve ⅛ of a revolution at every stroke, thus ensuring a round, even hole. The electric drill has a capacity to bore a hole 1½ to 2 inches in diameter at the rate of something over 2 inches a minute in very hard granite. It can bore if necessary to a depth of 10 or 12 feet, as the power of the coils is sufficient to raise a very heavy drill rod. This latter point is



one of much importance, and is a peculiarity of the Van Depœle machine. The drill received its current from a Type D-10 direct current dynamo of the motor type, fitted with a special mechanism consisting of a third or rotating brush. The power absorbed by the drill is only about 2 H.P., and as the voltage employed is 220, it may be placed at a very considerable distance from the dynamo with a comparatively small outlay for copper.

The electric hoist shown by the Thomson-Houston Company was also the object of much interest. A 15 H.P. motor is geared directly to the hoisting drum, making a very compact and semi-portable arrangement of considerable value in mines either for use at the head of the shaft or underground.

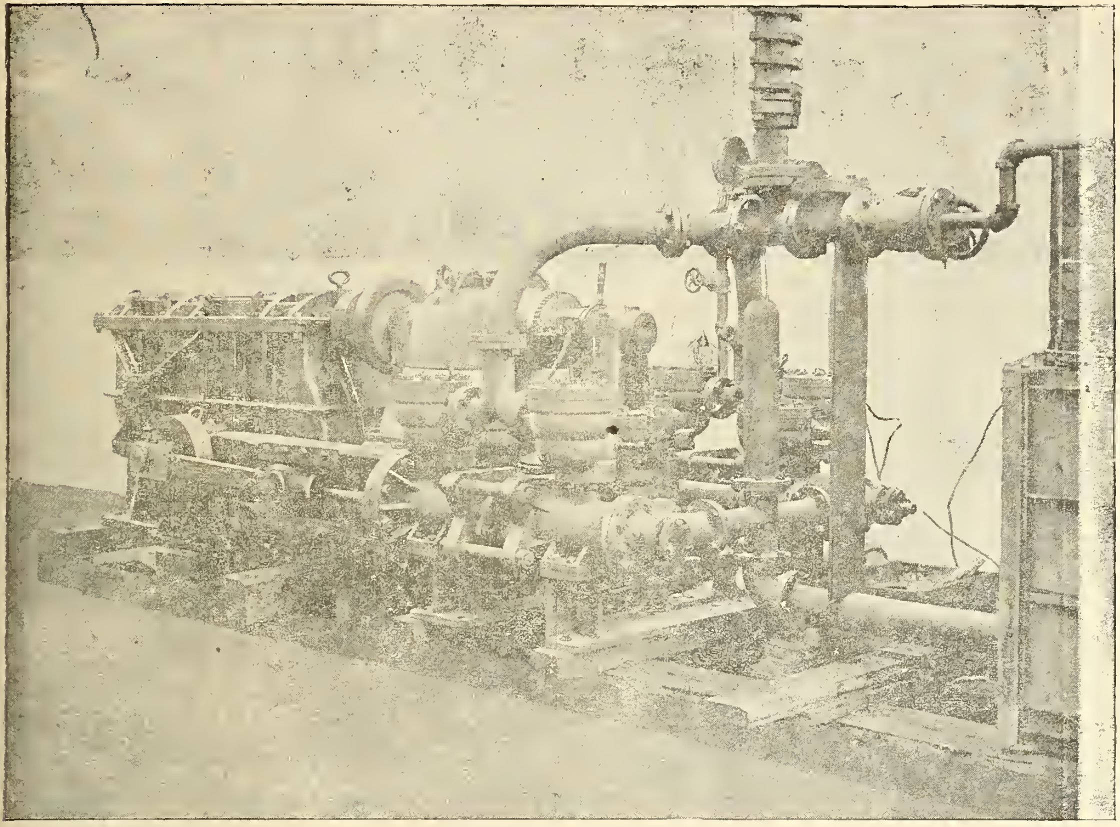
Another very fine mining exhibit was that displayed by

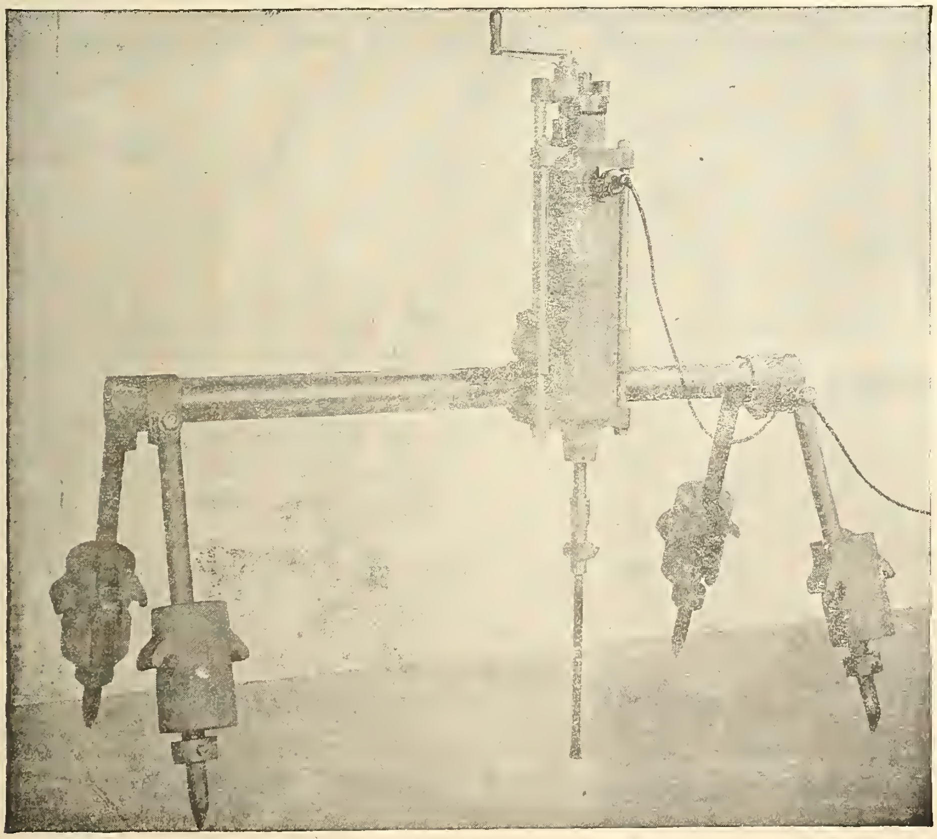
THE EDISON GENERAL ELECTRIC COMPANY.

Their space occupied one-half of the entire hall, and included many new appliances. Notable among these were the various mining apparatus recently developed and perfected. The following despatch, sent out by the Associated Press indicates the interest manifested in this new field of electrical work:

"Great interest has been manifested here in the new Edison electric mining appliances, exhibited in the Electrical Exposition.

"The most striking of these is the electric percussion drill, which will bore at the rate of three inches per minute in the hardest granite. It requires but little power to operate, and can be worked any distance from the dynamo to a limit of three miles. The drill is very simple in construction, having no moving parts except the plunger, and nothing that will be affected by moisture. This device, it is said by experts, will completely revolutionize mining work.





"The next in importance is the diamond prospecting core drill, designed for locating mineral deposits. It will bore 150 feet into the earth, bringing out a specimen of the mineral for the purpose of determining its value. Some have likened this drill to the mythical 'divining rod' which was supposed to indicate the location of minerals. The Edison drill certainly resembles such an invaluable instrument.

"Aside from these are exhibited electric coal drills, electric hoists, electric fans and electric pumps, showing that Edison has turned his attention in earnest to mining work, and many are expecting marvellous results from this branch of electricity in the near future."

Herewith is shown a view of these truly remarkable drills, taken from a photograph made at Denver, Col.

A point of especial interest to Canadians is the fact that all the apparatus in the immense Edison exhibit was made on Canadian soil and by Canadian workmen.

The Edison General Electric Company have recently completed their new factory at Peterborough, Ont., enabling them to supply the Canadian market with great promptness.

◆

The Sources of Petroleum.

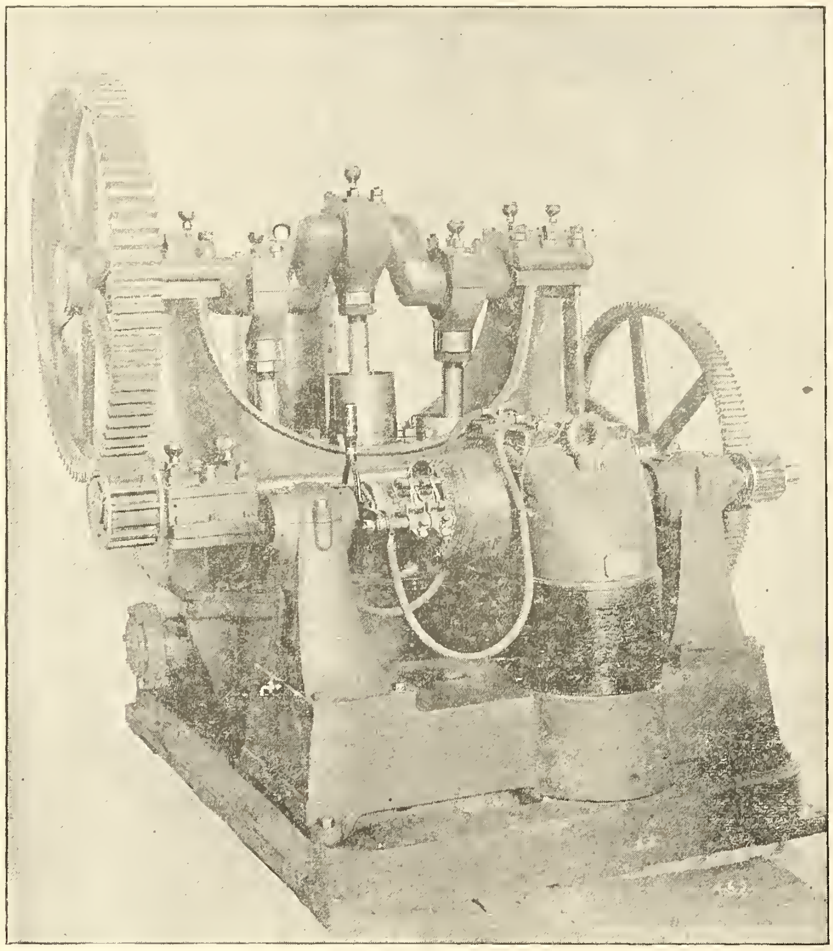
In a lengthy paper on the sources of petroleum and natural gas, Mr. W. Topley gives a general survey of the geological conditions under which they occur in various parts of the world, and enumerates the conclusions to which geologists of the United States have been led as regards the vast areas with which they deal. Two theories of the origin of petroleum have been advanced. The first ascribes it to a purely chemical origin, and is drawn chiefly from the data of the Russian fields; the second is the organic theory of distillation from organic remains, and explains best the facts over the greater part of North America. The great pressure of gas and petroleum does not prove its deep-seated origin, but arises from the form of the stratification in the American fields. In Canada and the United States the petroleum is usually found in anticlinals or interruptions to the dip in porous beds, such as sandstones and limestones. At the outcrop of these rocks the petroleum has disappeared, and its place is taken by water, which by its hydrostatic pressure causes the petroleum or gas to rise in the wells. This is readily seen in Indiana, according to Professor W. J. McCree, in the Cincinnati Arch, which is practically a dome some fifty miles across. Dr. T. Sterry Hunt, too, has shown that oil was produced in beds near where it is found; that their perosity accounts for the stores in them, and that petroleum and gas mainly occur along anticlinal lines. When the strata are much disturbed, large stores of oil or gas are not likely to be found.

There is no uniformity in the geological ages of the strata which yield petroleum. Even in North America, the age ranges from lower silurian to tertiary; both gas and oil also occur in the drifts.

Rocks of secondary age, however, with the exception of the cretaceous, are not oil-bearing in North America. In Europe, only small quantities occur in palæozoic rocks. In Holland, the range is from trias to cretaceous. In Eastern Europe it is mainly tertiary, and wholly so in the Caucasus.

In other parts of the world the petroleum-bearing beds are, so far as is known, rarely of older date than upper secondary. Volcanic rocks occasionally contain petroleum, but there is good reason to believe that these cases are generally impregnations into porous reservoirs of volcanic rocks from neighbouring sedimentary strata.

The author then proceeds to deal at length with the oil and gas deposits of the United States, Canada and the Caucasus. Besides these countries, the following are mentioned as producers, and are more or less briefly described: Mexico, Venezuela, Trinidad, Columbia, Peru, Argentine Republic, Egypt, Algeria, the Carpathians, Germany, Italy, France, Spain, India, Burmah, Japan, China, and New Zealand. As regards the United Kingdom, the author gives particulars of the various instances in which gas or oil has been found in small quantities. The production of petroleum in Derbyshire, in the three years, 1886 to 1889, was 43, 66 and 35 tons respectively. In spite of the frequent occurrence of brine in borings, and the presence of fossiliferous strata, but very little oil has been found up to the present. This may be due to the frequent foldings and contortions of the palæozoic rocks, so that volatile matters have had every chance of escaping, though otherwise these rocks are most likely to contain oil. In many cases the brine may have replaced the escaped oil. The Sub-Wealden boring in Sussex was favourably placed for discovering petroleum, but none was found.



With regard to the duration of the supply, the author states that the recent diminution in the American supply is due to the restrictions imposed.

If the records of each field be examined separately it is seen that the production has rapidly developed, and then slowly declined, in some cases to zero.

The increased production is due to the discovery and development of new productive areas. This is especially the case with districts of high pressure gas or oil, whereas low pressure fields have longer lines. The chief exception to this rapid exhaustion of high pressure areas is Baku; but even here there are said by some to be signs of exhaustion.

The history of all high pressure wells is substantially the same; first, an enormous supply, and then signs of brine, followed by an increasing quantity, which finally spoils the well. To yield brine, with only a small proportion of oil, is the final stage of almost all high pressure wells. It is true that a small supply of oil with much brine may continue for several years.

Such wells may pay in Germany, where there is a protective duty on imported petroleum, but they are at present worthless in highly productive areas. The time may, however, come when even the American oil men will return to their now deserted "pools," and be content with the small production of old wells, now shut down and abandoned.

The comparative permanence of low pressure areas is a hopeful sign for the future of petroleum. What is most wanted is a steady production, not subject to enormous variations in quantity, and consequently in price.

◆

Mining at Great Depths.—The question of working coal at depths from 2,000 to 4,000 feet was investigated hy the Royal Commission of 1869, but since then, according to Mr. W. E. Garforth, some three thousand million tons of coal have been raised, and the depth of workings have been increased from 2,376 feet up to 3,120 feet. Discoveries in connection with colliery appliances, especially in electrical work and increased knowledge in methods of working coal, have produced a feeling that coal may be worked at much greater depths than at present. At the same time there are many difficulties in the way. At Ashton Moss Colliery the increase of temperature is one degree for every 75 feet, but there are reasons for believing that the increase has a diminishing ratio. In the six-foot seam in this colliery, at a depth of 3,120 feet, the temperature is 87° F., and the air in the roadway and at the face is dry and not surcharged with moisture, as has been predicted. The men work for the same hours, but not with the same energy and vigor as in shallow pits. No water is met with, and not more gas than in other mines. The quality of the coal is as good as, if not superior to, that of coal found at less depths. The author makes a number of suggestions for working deep mines. He is of opinion that coal ought to be won without greater loss than in the past; and he believes that coal will be worked at as great depths as it can be proved to exist.

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In the construction of the new iron bridge over the River Weichsel, Germany, ignot metal will be used. There will be five spans of 328 feet, and thirteen of 203 feet.

Mining Taxes in Michigan.

Iron mining companies will be particularly interested in the work of the Michigan State Board of Equalization, just brought to a close. The valuation of the state was equalized at $1,230,000,000, an increase of $184,550,000 over its value as equalized five years ago. This increase includes $75,000,000 worth of mining property which will this year be subjected to direct taxation for state purposes for the first time. After having adjusted the difficulties which they deemed existed between the valuation of the several counties, as equalized by the boards of supervisers, the state board added 15 per cent. to cover the material growth of the state during the last half decade. The books of the Auditor General's Office show that the specific taxes received from mines for the past five years averaged $80,000 per year, and this amount the mining counties, as equalized, will pay in direct taxes. It was also ascertained by the board that the non-producing mines, valued at $10,000,000, paid nothing in state taxes under the old law. These will now pay their proportion of the state tax, heing directly assessed therefor, on the same value at which they were assessed for local purposes.—*Cleveland Iron Trade Review.*

◆

Storage of Petroleum.—Mr. W. T. H. Carrington, in a paper read before the Institution of Civil Engineers, March 24, 1891, describes the appliances necessary for dealing with petroleum in bulk and the methods of using them. The mains forming the pipe lines are from 6 to 8 inches in diameter, and are usually of wrought iron. A flexible tube of canvas or other material is used for making connection with the steamer. The petroleum is passsed through a dirt tank into the storage tanks by pipes entering at the sides or bottom. The suction and delivery pipes should preferably be kept independent. The author deals with the size of the tanks and their construction, special attention being given to the foundation. In hot climates the top of the tank is covered with water. The bottom of the tank should be placed so that it can he inspected. Petroleum can be withdrawn from the tanks by gravity, or by power when it is barrelled. A description of the method of barrelling is also given.

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New Bar Mill.—A new bar mill has recently been erected at the Milwaukee works of the Illinois Steel Company. It has a 9 inch train, consisting of five stands of housings. Three sets of rolls are three high; there is one set of oval rolls, and one of finishing rolls. The three-high sets are made with closed tops, having brass centre-screw box, steel screws and bronze journal bearings. The oval and finishing sets have open tops with spring carriers for the upper roll, thus doing away with liners when rolling different thicknesses of flats, the spring bringing the upper roll into proper position when the holts are slackened. The pinions of the train are also open tops, with Hunter's self-oiling bearings. A Smythe-Laughlin regenerative furnace is used, 14 feet in length from bridge to bridge, and 7 feet from wall to wall, with four doors. —*Iron Age.*

—EDISON PERCUSSION AND ROTARY DRILLS—
DENVER COL.

Minimum First Cost of Plant and Maximum Economy of Operation in the Electrical Transmission of Power.

(By H. Ward Leonard, New York.)

A great deal has been, and is being written and said about the condition governing the minimum first cost of a plant for the transmission of power by electricity, and also about the conditions governing the maximum economy of operation of such a plant, and some radical errors and false deductions have been made by those who are considered authorities upon this subject, so that it is not surprising that a somewhat erroneous idea at present exists in the mind of the electrical public upon this question.

As a rule, the theories and deductions developed by the various papers on this subject have given as a conclusion certain formulæ and laws the application of which is practically impossible because of the necessity of using factors, the determination of the value of which is fully as great, if not greater, a problem than that, the solution of which is attempted. The result of this has been that vital errors in some of the most noteworthy papers on this subject have remained unnoticed by most readers, and even if others besides the writer have been familiar with these errors, they have probably felt as he did, that no good purpose would be served by calling attention to them, as no practical application seemed to have been attempted of these formulæ or laws.

The recent publication, however, of a compilation entitled, "Electrical Transmission Hand-Book," by F. B. Badt, makes it appear of importance to call attention to the serious errors contained therein, for Mr. Badt not only publishes all the original errors of the authorities he quotes, but he proceeds to carry the erroneous deductions further and to give and solve practical problems in a manner such that the reader cannot but receive a clear and definite, although entirely incorrect understanding of the subject. Furthermore, some of the formulæ published by Mr. Badt, and for which the present writer is responsible, have been interpreted by means of erroneous laws laid down by Mr. F. J. Sprague, and consequently an entirely false meaning has been given to formulæ which, when properly interpreted, are entirely correct. In order to point out the errors mentioned in as clear a manner as possible, I shall first treat the subject generally and deduce the correct laws, and then point out the inconsistencies and inaccuracies of the conclusions, formulæ and laws given by Mr. Sprague and Mr. Badt.

Under date of August 16, 1886, the writer published a general formula for the determination of the size of conductors which should supply devices arranged in multiple arc, the form of which was as follows :—

$$M=\frac{\text{K. W.}\times D\times 21{,}400}{V\,(E-V)}\,; \qquad (1)$$

in which M = Circular millage of conductor.
K. W. = Kilo watts at terminals of translating device.
D = Distance of transmission in feet.
E = E. M. F. at generator brushes.
V = Volts lost in transmission.

For the sake of explicitness I will indicate the derivation of the formulæ.

Res. of 1 foot cir. mil of commercial copper .... $=10.7$ ohms.
Res. of 2 D feet of conductor of 1 cir. mil. .... $=21.4\,D$
Res. of 2 D feet of conductor of M cir. mil. .... $=\dfrac{21.4\,D}{M}$

$$M=\frac{21.4\,D.}{R} \qquad \text{Now } R=\frac{V}{C}=\frac{V}{\dfrac{1{,}000\ \text{K. W.}}{E-V}}=\frac{V\,(E-V)}{1{,}000\ \text{K.W.}}$$

$$\therefore M=\frac{21.4\,D\times 1{,}000\ \text{K.W.}}{V\,(E-V)}=\frac{\text{K. W.}\times D\times 21{,}400}{V\,(E-V)} \qquad (1)$$

Weight of 1 ft. cir. mil of copper = .000003027 lb.

∴ Calling T the weight of conductor in lbs. and allowing 3 per cent. for sag, etc.

$$T=\frac{D^2\times \text{K. W.}}{V\,(E-V)\times 7.5} \qquad (2)$$

Calling B the cost of conductor in dollars, we have, with copper at L cents per pound.

$$B=\frac{D^2\times \text{K. W.}\times L}{750\,V\,(E-V)} \qquad (3)$$

∴ The cost of the conductor per K. W. at motor brushes is :

$$\frac{B}{\text{K.W.}}=\frac{D^2\,L}{750\,V\,(E-V)} \qquad (4)$$

Calling G the cost of dynamo electric machinery per K. W. at brushes and $\frac{A}{\text{K.W.}}$, the cost of generator per K.W. at motor brushes, we have

$$\frac{A}{\text{K.W.}}=\frac{100\,G}{100-P} \qquad (5)$$

where P = the percentage of loss in the conductor ; this may also be expressed as follows :

Cost of generator per K. W. at motor brushes,

$$\frac{A}{\text{K.W.}}=\frac{G\,E}{E-V}\,. \qquad (6)$$

The cost of the generator and of the bare copper for the conductors are the only two elements of the cost of a power transmission plant which it is necessary to consider in the determination of the condition of Minimum First Cost of Plant, for the other factors of the cost of the plant, such as the development of the motive power, the labor of erecting the line, etc., are not proportionate to the power delivered, and hence should not be considered in the determination of the minimum conditions.

With any given initial E. M. F. and distance, it is evident that the more volts we lose in the transmission, the less will be the cost of the conductor ; but at the same time the cost of the generator per unit of power transmitted will be increased because of the additional generator capacity required to take care of the increased amount of energy lost in the conductors.

Hence it is evident that for any given initial E. M. F. and distance there must be some particular loss in the conductor which will make the combined cost of the generator and conductor a minimum. We can determine the minimum value by placing the first differential of the expression indicating the sum of the costs of the generator and the conductor equal to zero.

From (4) and (6) we have, cost of generator plus cost of conductor.

$$=\frac{A+B}{\text{K.W.}}=\frac{G\,E}{E-V}+\frac{D^2\,L}{750\,V\,(E-V)} \qquad (7)$$

Placing the first differential = 0 we have :

$$\frac{G\,E}{(E-V)^2}-\frac{750\,D^2\,L\,(E-2V)}{750^2\,V^2\,(E-V)}=0. \qquad (8)$$

From which we get,

$$D^2=\frac{750\,G\,E\,V^2}{L\,(E-2V)} \qquad (9)$$

This last equation expresses the relation existing under the conditions of Minimum First Cost of generator and conductor, and consequently of the entire plant.

$$\text{Since} \qquad \frac{E}{E-2V}=\frac{100}{100-2P} \qquad (10)$$

we have from (9) and (10)

$$D^2=\frac{75{,}000\,G\,V^2}{(L\ 100-2P)} \qquad (11)$$

Calling $\frac{Bm}{\text{K.W.}}$, the cost of conductor in dollars per K. W. at motor brushes under conditions of minimum first cost of plant, we have from (4) and (11)

$$\frac{Bm}{\text{K.W.}}=\frac{G\,E\,V}{(E-V)\,(E-2V)} \qquad (12)$$

$$\text{and}=\frac{100\,G\,P}{(100-P)\,(100-2\,P)} \qquad (13)$$

Calling $\frac{Am}{\text{K.W.}}$ the cost of generator in dollars per K. W. at motor brushes under conditions of minimum first cost of plant, we have from (6) and (9)

$$\frac{Am}{\text{K. W.}}=\frac{D^2\,L\,(E-2V)}{750\,V^2\,(E-V)}\ \text{and} \qquad (14)$$

$$=\frac{D^2\,L\,(100-2P)}{750\,V^2\,(100-P)} \qquad (15)$$

When the cost of dynamo is $33 per K. W. at brushes and copper is 20 cents per lb., that is, when G = 33 and L = 20, we have, from (11),

$$D^2=\frac{123{,}750\,V^2}{100-2P} \qquad (16)$$

$$\text{From (3) we have } D^2=\frac{\dfrac{Bm}{\text{K. W.}}\times 750\,V\,(E-V)}{L} \qquad (17)$$

With any fixed initial E. M. F. and a certain percentage of loss, we can get by (13) the value of $\frac{Bm}{\text{K. W.}}$, the cost of the conductor under conditions of minimum cost ; and knowing the cost of the conductor, we can by (17) get the value of D. Thus for any initial voltage and percentage of loss we can determine the cost of conductor and the distance of transmission which corresponds to the minimum first cost of plant. By determining such values at 10, 12½, 15, 20, 25, 30, and 40 per cent., we are able to plot the lines of minimum first cost as given by the accompanying Chart 1.

By the use of Chart 1 we can quickly determine the percentage of loss necessary for any initial E. M. F. and distance in order that the cost of plant shall be minimum; and we also learn at the same time the corresponding cost of the generator and of the couductor.

Thus, if we have an initial E. M. F. of 3,000 volts and a distance of 50,000 feet, we must in order to secure the minimum first cost of plant, operate with a loss of 30 per cent. and in such case the cost of generator = $47.15, and cost of conductor = $35.35, per K. W. at motor brushes; so that adding the cost of motor, $33 per K. W., we have total cost of generator, conductor and motor $115.50. (*Example 1.*)

Similarly, if we have a distance of 30,000 feet and 3,300 volts initial E. M. F. we must operate at 20 per cent. loss, and the total cost of the generator, conductor and motor will be $88.00. (*Example 2.*)

Now, it by no means follows, because we are working with the minimum first cost of plant for a certain voltage and distance, that we are working at the highest economy, for, evidently, it is possible that if we work with a less percentage of loss in the case cited in Example 1, although our investment be increased thereby, the interest and depreciation on this increase of investment may be much less than the saving we would effect, due to the reduction of the loss of energy in the conductors. In other words, we must consider the variation in the interest and depreciation upon the investment, as well as the variation in the value of the energy wasted in the conductors, and must make the sum of the interest and depreciation on investments plus the value of the energy wasted in the conductor, a minimum, in order to operate at the maximum economy.

The interest on the investment can be definitely determined, but the value of the energy wasted it is very difficult to determine before the installation is made, for the reason that it is usually impossible to ascertain exactly how much of our total power will be transmitted in the future, as this is usually dependent upon an unknown demand. In addition to this, the value per K. W. of the power wasted will frequently be almost nothing in the beginning, when a large water power is available and there is a demand for but a small portion of it, but later the value per K. W. of the energy wasted would probably be much greater.

Thus, while we can determine with absolute accuracy the Minimum First Cost, the question of the Most Economical First Cost is a question almost entirely for the investor to decide. We should be able to tell him not only the minimum first cost and its corresponding percentage of loss, but also the cost corresponding to any other loss than that demanded for the minimum cost.

In order to accomplish this I have designed Chart 2, which gives not only the cost of plant and necessary percentage of loss for any case, of initial E. M. F. and distance under the conditions of Minimum First Cost, but it also gives the cost of plant for the given initial E. M. F. and distance with any other percentage of loss.

Thus if, as in Example 1, the distance is 50,000 feet and the initial E. M. F. 3,000 volts, we find, by examining the curve in which the initial E. M. F. equals 60 volts per 1,000 feet, that the minimum first cost of plant will be realized when we operate at 30 per cent. loss and that the corresponding cost of generator and conductor is $82.50, making the total cost of the generator, conductor and motor $115.50.

We also learn that if, with the same initial E. M. F. and distance, we operate at various losses, the cost of generator and conductor varies as follows :—

30 per cent. loss......................	$ 82.50
25 " "	83.20
20 " "	87.20
15 " "	90.60
10 " "	119.00

If now we have a superabundance of water power and are transmitting but a small fraction of it and the value of the energy wasted is consequently negligible, we would do better to operate at 30 per cent. loss and reduce our investment to a minimum. But if our power be limited and valuable so that the value of the energy wasted becomes an important consideration, we must then, for the highest economy, operate at such a loss in conductors that, although the cost of plant may not be a minimum, the sum of the interest and depreciation on such cost, plus the value of the energy wasted will be a minimum. It will be evident that when such sum is a minimum we will be operating at the highest economy. To determine this minimum let us call I the rate of interest and depreciation on the investment, expressing I in per cent. Let U be the value of 1 K. W. at the brushes of the motor, used as it will be used in practice. Then from (7) we have :

$$\left.\begin{array}{l}\text{Int. and depreciat'n}\\ \text{on capital invested}\\ \text{in generator and con}\\ \text{ductor per K. W. at}\\ \text{motor brushes....}\end{array}\right\}=\frac{I}{100}\left(\frac{G\,E}{E-V}+\frac{D^2\,L}{750\,V\,(E-V)}\right) \qquad (18)$$

The value per K. W. at motor brushes of the energy wasted in the conductor per annum will be

$$\frac{V\,U}{E-V} \qquad (19)$$

The sum of (18) + (19) is that portion of the cost of operating subject to variation by a variation in the loss in the line, and to learn when this is a minimum we will place the first differential of

$$(18)+(19)=0.$$

Doing this, we find that the equation expressing the condition of Minimum Operating Expenses, or, in other words, Maximum Economy of Operation, is

$$D^2 = \frac{750\ E\ V^2\ (I\ G + 100\ U)}{L\ I\ (E-2V)} \qquad (20)$$

From this, calling B_E the cost of conductor under conditions of maximum economy, we find

$$B_E = \frac{E\ V\ (I\ G + 100\ U)}{I\ (E-V)\ (E-2V)} \qquad (21)$$

and calling Ae the cost of generator under conditions of maximum economy, we find,

$$Ae = \frac{D^2\ L\ (E-2V)}{750\ V^2\ (E-V)} - \frac{100\ E\ U}{I\ (E-V)} \qquad (22)$$

CHART NO. 1.

TRANSMISSION OF POWER.

BY H. WARD LEONARD.

Showing Minimum First Cost of Plant, under Varying Distances and Initial E. M. F.'s.

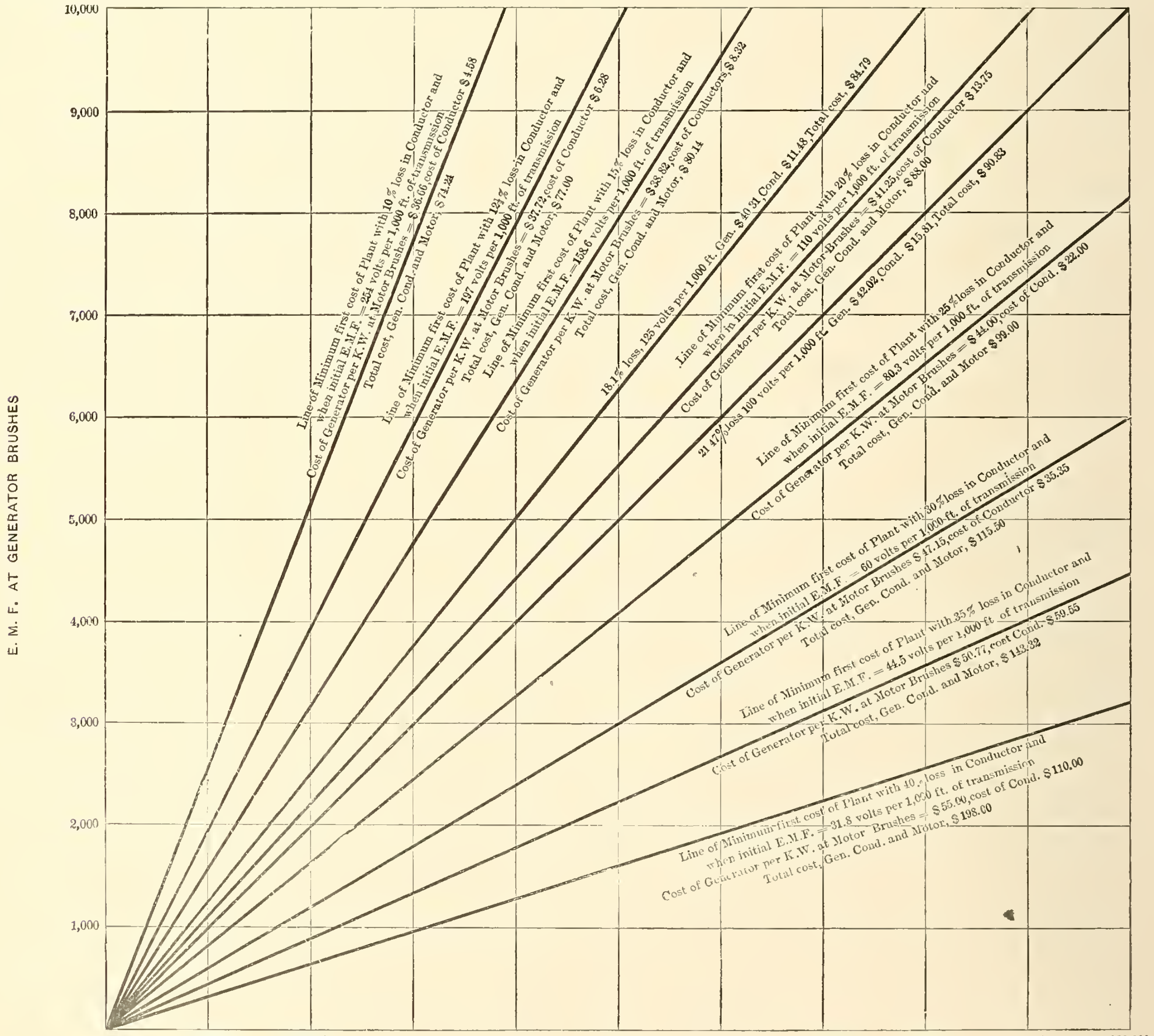
D = Distance of transmission in feet.
E = Initial E. M. F.
V = Volts lost in transmission.
G = Cost of dynamos per K. W. at brushes.
L = Cost of bare copper in cents, per lb.
$\frac{Am}{K.W.}$ = Cost of generator per K. W. at motor brushes under conditions of minimum first cost.
$\frac{Bm}{K.W.}$ = Cost of conductor per K. W. at motor brushes under conditions of minimum first cost.

Under conditions of minimum first cost of plant and when G = \$33.00 and L = 20 cents.

$$D^2 = \frac{123{,}750\ V^2}{100-2P}$$

$$\frac{Am}{K.W.} = \frac{D^2\ L\ (E-2V)}{750\ V^2\ (E-V)} = \frac{D^2\ L\ (100-2P)}{750\ V^2\ (100-P)}$$

$$\frac{Bm}{K.W.} = \frac{G\ E\ V}{(E-V)\ (E-2V)} = \frac{100\ G\ P}{(100-P)\ (100-2P)}$$



Elec. Engr., N. Y.

From this relation we can plot curves which will enable us to quickly determine the conditions of maximum economy in practice. A set of such curves is shown in CHART 3.

CHART 3 is designed for transmission in which 100 volts are allowed per 1,000 feet of transmission. Two sets of curves are plotted, one marked X, assuming the combined interest and depreciation to be 10 per cent. per annum, and the other set assuming 15 per cent. for these items.

The value of the energy wasted is also plotted when the value of the energy is \$5, \$10 and \$20 respectively, per kilo-watt at motor brushes; and then each of these latter curves is combined with each of the former, giving as a result the operating cost under six different conditions and indicating the maximum economy in each case, and also the variation in the expense due to any deviation from the loss corresponding to the maximum economy.

Example 3. For instance, suppose a transmission of 30,000 feet with 3,000 volts initial E. M. F., and suppose we value interest and depreciation at 15 per cent. per annum. Also, suppose our power to have a value at first of \$5 per K. W. at generator brushes. By CHARTS 2 and 3 we find that the maximum economy will be realized when we operate at 17 per cent. loss, although the minimum first cost of plant alone would be realized when we operate at 21.47 per cent.

If later on in this same plant the increasing scarcity of power makes its value \$20, instead of \$5, per K. W. we find that we must arrange our plant as we increase it, so that the loss shall be 11½ per cent. since by CHART 3 we find we will then be operating at the maximum economy.

It will be seen that by the use of these formulæ and their resultant curves any problem in the transmission of power can be readily and accurately determined. The value of these curves will be evident, when attention is called to the fact that there is in use in this country a plant put in by one of the leading companies, in which the equivalent of the following conditions prevail. Initial E. M. F. 2,200 volts; distance 50,000 feet; loss in conductor 50 per cent. The company who installed this plant even now consider it satisfactory; yet we see from CHART 2, by examining the curve of 44 volts per 1,000 feet, that with exactly the same cost of generator and conductor they could have operated at 22 per cent. loss instead of 50 per cent., making a net gain in the power delivered of 56 per cent., or they might have made a saving in their investment of \$10 per kilo-watt delivered by conductor with an increase in power of 30 per cent., had they worked at 35 per cent. loss in conductor, which is that required for minimum first cost.

The following examples will serve to give a clear idea of the use of these curves:

Example 4. Suppose a proposed transmission of 30,000 feet, and that 6,000 volts is the highest voltage we have dynamos for; that is, 200 volts per 1,000 feet. By CHART 1 we learn that for minimum first cost we must lose 12½ per cent. in conductor, that the cost of bare copper conductor will be \$6.28 per K. W., that of the generator \$37.72; total cost of generator, conductor and motor \$77.

Example 5. If we have but 3,000 volts available for the initial E. M. F., we must for the minimum first cost lose 21½ per cent. The cost of conductor will be \$15.81, that of generator, \$42.02; and that of generator, conductor and motor, \$90.83.

Example 6. If, instead of 12½ per cent. loss, we wish to lose less, we find from Chart 2 that the cost of such generator and conductor will be as follows: 6,000 volts and 5 per cent., $50; 6,000 volts 10 per cent., $43.25. Knowing the value of the power and the rate of interest and depreciation, we can determine which loss to operate at. It will be noticed that with 6,000 volts, we should, under no circumstances, lose more than 12½ per cent. in the conductor, as with greater losses not only the waste of energy increases, but also the cost of plant.

Chart No. 2

TRANSMISSION OF POWER.

BY H. WARD LEONARD.

Showing Minimum First Cost of Plant for any Distance and Initial E. M. F. *with Corresponding Necessary Loss in Conductor, and also Showing Variation in Such Cost Occasioned by Losses other than those Necessary for Minimum First Cost.*

D = Distance of transmission in feet.
E = Initial E. M. F.
V = Volts lost in transmission.
G = Cost of dynamos per K. W. at brushes.
L = Cost of bare copper in cents per lb.
$\frac{\text{Am}}{\text{K. W.}}$ = Cost of generator per K. W. at motor brushes under conditions of minimum first cost.
$\frac{\text{Bm}}{\text{K. W.}}$ = Cost of conductor per K. W. at motor brushes under conditions of minimum first cost.

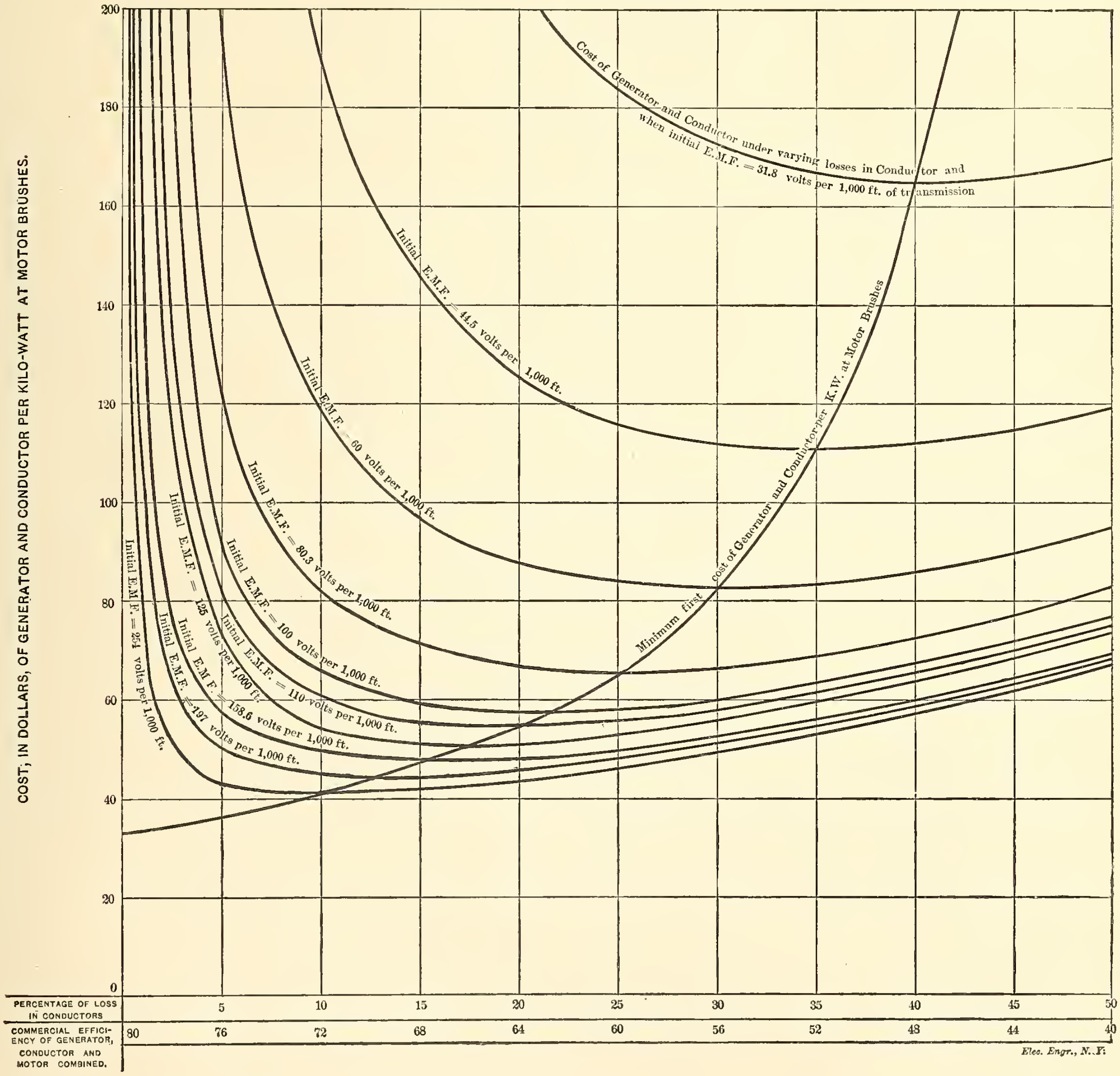
Cost (in dollars) of bare copper conductor per K. W. at motor brushes (general case). $= \frac{D^2 L}{750 V (E-V)}$

Under conditions of minimum first cost of plant and when G = $33.00 and L = 20 cents.

$$D^2 = \frac{123{,}750\ V^2}{100-2P}$$

$$\frac{\text{Am}}{\text{K. W.}} = \frac{D^2 L (E-2V)}{750 V^2 (E-V)} = \frac{D^2 L (100-2P)}{750 V^2 (100-P)}$$

$$\frac{\text{Bm}}{\text{K. W.}} = \frac{G E V}{(E-V)(E-2V)} = \frac{100 G P}{(100-P)(100-2P)}$$



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There are four factors in a transmission plant—the distance, the initial E. M. F., the percentage of loss, and the cost of plant, and knowing any three we can by Chart 2 get the fourth. We have already considered the case of fixed distance, initial E. M. F. and per cent. of loss.

Suppose now, distance, loss and cost be fixed and we want to determine initial E. M. F. necessary.

Example 7. Suppose the distance as before 30,000 feet, and that the loss must not exceed 20 per cent., an that the cost of generator and conductor must be $55 per K. W. invested in the best possible way. By Chart 2 we find that with 110 volts per 1,000 feet, that is, 3,300 volts initial E. M. F., our loss will be exactly 20 per cent. and the cost exactly $55. Also, that with 7,620 volts initial we need only lose 10 per cent., and still the cost will be only $41; and by using 3,750 volts and 11 per cent. the cost will still be but $55; also by using 6,000 volts initial and 3½ per cent. loss the cost would be only $55.

The next case will be where distance, initial E. M. F. and capital to be invested are fixed, and we wish to determine the percentage of loss necessary.

Example 8. Suppose distance 30,000 feet; initial E. M. F. 1,800 volts; capital to be invested, $100 per K. W. for generator and conductor. Having 60 volts per 1,000 feet available, we find that we must operate at 14 per cent. loss.

Now suppose investment, initial volts and permissible loss to be fixed, and we want to find the maximum possible distance of transmission.

Example 9. Suppose investment, in generator and conductor fixed at $60; initial volts, 2,400; percentage of loss, 15 per cent. We find that the maximum distance corresponding is 24,000 feet.

Let us now briefly examine the formulæ and laws which have been referred to by Mr. Badt in his "Electric Transmission Hand-Book." Mr. Badt quotes freely from a paper by Mr. F. J. Sprague, read before the Franklin Institute, which was printed in the *Journal* of the Franklin Institute for April, 1889. By careful examination of the paper it will be found that, after having assumed the value of the E. M. F. at the motor brushes and the distance also being fixed, the error is made afterward of considering the results obtained as applicable to cases in which these values are variable. Hence it is not surprising that we find Mr. Sprague saying: "That is with fixed conditions of cost and efficiency of apparatus the number of volts fall, to get the minimum cost, is a function of the distance alone and is independent of the E. M. F. at the motor, a somewhat startling conclusion."

In the light of what we have already seen, it will be evident that this statement is entirely incorrect. To make this more clear (*Example 10*), suppose that with the same distance as in *Example 1*, that is, 50,000 feet, and the same efficiency of apparatus, that is 30 per cent. loss in conductor, we use the initial E. M. F. of 6,000 instead of 3,000, and consequently have an E. M. F. at the motor of 4,200 volts, instead of 2,100 volts as before. Now, according to Mr. Sprague, the "minimum cost of plant is a function of the distance alone and is independent of the E. M. F. used at the motor;" yet it will be evident that in *Example 10* the cost of the conductor is only ¼ of that in *Example 1*, and the cost of the generator is the same; hence the total cost is much reduced. In other words, while, if we fix the initial E. M. F. and distance, there is a definite loss in conductor at which we must operate in order to have a minimum first cost of plant, it by no means follows that if we fix the distance and percentage of loss there is a definite initial E. M. F. which corresponds to a minimum first cost of plant; for evidently, the higher we make the initial E. M. F., meantime keeping the percentage of loss constant, the more we reduce the cost of plant, and there is no minimum value under these conditions.

Following out the same error, Mr. Sprague also lays down the following incorrect law: "With any fixed couple and commercial efficiency the cost of the wire should bear a definite and fixed ratio to the cost of the generating plant." It will be evident from what we have just seen regarding the preceding law, that this one is equally as incorrect and formulæ (13) and (15) clearly indicate the impossibility of either of them being correct. In his paper Mr. Sprague gives several tables based upon these laws, and since this same error is maintained throughout, his results are entirely incorrect.

Mr. Badt has not only followed Mr. Sprague blindly, but has gone much further and has finally brought up with such remarkable results, that we find him, after stating some of these surprising conclusions, saying: "At the same time it seems somewhat startling that for the minimum cost of the installation under given conditions as mentioned before (*i. e.*, fixed cost and efficiency of apparatus), the volts lost in the conductor are dependent upon the distance alone."

It seems almost impossible that such a statement as this could be seriously made by an electrical engineer of practical experience, yet we find Mr. Badt giving examples and tables in which it is surprising that he did not see the absurdity of this statement. For instance, on page 28 he gives "*Example 1.* Distance, including 5 per cent. for sag, 7,000 feet; E. M. F. at motor terminals, 500 volts. What must be the loss in the wire and E. M. F. of generator for minimum cost of plant?"

Mr. Badt, by the aid of Mr. Sprague's laws, with his own additions, concludes that he must have 20 per cent. loss in conductor; hence 625 volts at the generator. Since the E. M. F. at the motor is fixed, is it not evident that the higher the initial E. M. F. and the less the percentage of loss in the line, the less will be the cost of

CHART NO. 3.

TRANSMISSION OF POWER.

BY H. WARD LEONARD.

Showing Maximum Economy of Operation when 100 Volts per 1,000 Feet are Used, and when Interest and Depreciation on Plant is 10 per cent. and 15 per cent., and when Value of Power at Generator Brushes is $5.00, $10.00 and $20 per K. W. respectively.

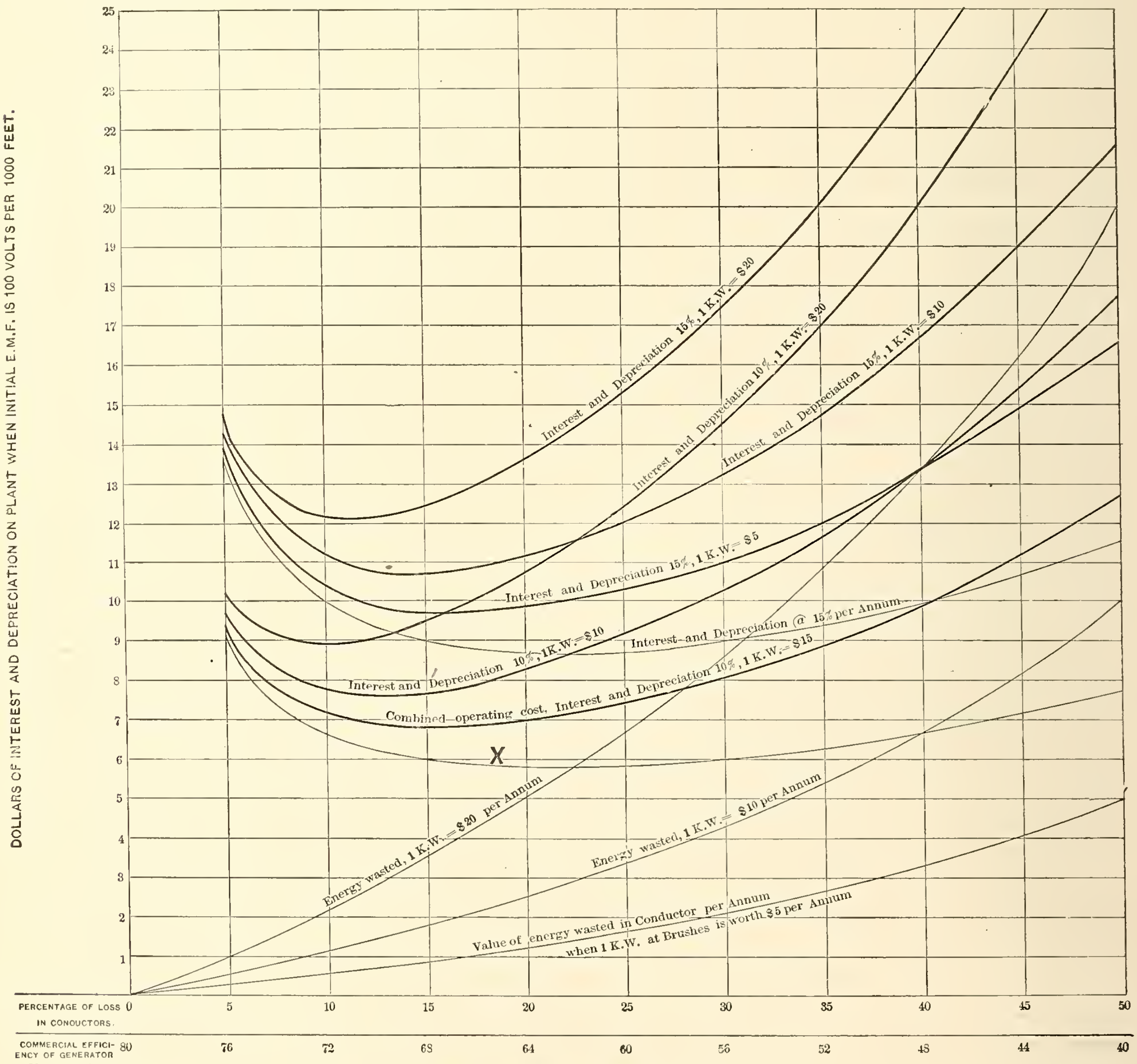
Ae = Cost of generator per K. W. at motor brushes under conditions of maximum economy of operation.
Be = Cost of conductor per K. W. at motor brushes under conditions of maximum economy of operation.
L = Cost of bare copper in cents per lb.
D = Distance of transmission in feet.
E = Initial E. M. F.
V = Volts lost in transmission.
G = Cost of dynamo per K. W. at brushes.
I = Interest and depreciation on cost of generator and conductor per K. W. at motor brushes.

U = Value of 1 K. W. per annum at brushes of motor as used.

$$D^2 = \frac{750\,E\,V^2\,(I\,G + 100\,U)}{L\,I\,(E - 2V)}$$

$$Be = \frac{E\,V\,(I\,G + 100\,U)}{I\,(E - V)\,(E - 2V)}$$

$$Ae = \frac{D^2\,L\,(E - 2V)}{750\,V^2\,(E - V)} - \frac{100\,E\,U}{I\,(E - V)}$$



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plant? In other words, if the cost be a certain amount at 20 per cent. loss in conductor with 625 volts initial, would it not be less with 10,000 volts initial and 1,000 volts loss in conductor or 10 per cent?

Similarly, "*Example 2.* Distance (including 5 per cent. for sag) 50,000 feet; we want to obtain at least 55 per cent. efficiency (from generating pulley to motor shaft). What is the voltage to be employed at motor and generator for minimum cost of plant?"

Mr. Badt finds that the E. M. F. generated must be 2,741 and that of the motor 1,850, with a loss in conductor of 32.5 per cent. Is it not evident that by using 5,482 volts at generator and 3,700 at motor the cost of generator is the same and the cost of conductor only ¼ what it was, and that there is no limit to the possible reduction in cost of the conductor; and hence no minimum value?

Mr. Badt, following the law that, "the number of volts to get the minimum cost of plant is a function of the distance alone," finds that for every 1,000 feet we must lose 17.5 volts and with fixed cost and efficiency of apparatus no other factors need be considered. This, certainly has the beauty of simplicity, and the tables built upon this conclusion leave little to be desired in that direction; but the transmitter of power who follows these tables will pay heavily for his faith in them.

Another law which Mr. Badt deduces after making the assumption that "$\frac{D}{V}$, the relation of distance to volts drop for a minimum cost of plant, is a constant," appears on page 37, and is as follows: "For minimum cost of plant the total weight of the conductor per horse power delivered by the motor shaft remains the same at a certain percentage of loss in the conductor, regardless of the voltage of motor and the distance." This involves the same erroneous assumptions and is evidently absurd, as is another law on page 39: "For minimum cost of plant the weight of the conductor depends only on the percentage of loss in the conductor and the number of mechanical horse power delivered by the motor."

Mr. Badt, on page 42, quotes from Mr. Sprague another equally misleading rule, viz: "For minimum initial cost of plant, and assuming certain prices per horse power of motors, generators and power plants (all erected and ready for operation), and assuming a certain price per pound of copper (delivered at the poles), the total cost of plant, excluding line construction, is a constant for a certain efficiency of the electric system, no matter what the E. M. F. of the motor and the distance may be." The absurdity of this is evident from what we have seen and is clearly shown by CHART 2.

We now come to a consideration of the conditions governing the maximum economy of operation.

Sir William Thomson, in a paper entitled "The Economy of Metal Conductors of Electricity," read before the British Association in 1881, stated the following law: "The most economical area of conductor will be that for which the annual interest on capital equals the annual cost of energy wasted."

This law has been accepted ever since that date with slight modifications, but upon close and practical investigation it proves to be entirely incorrect as applied to maximum economy of operation of a plant, for the very surprising reason that no account whatever is taken of the fact that the cost of the generator per horse power transmitted will vary as the loss in the line varies.

Since the variation in the cost of the generator is the principal factor, it is not surprising that the correct minimum and that obtained from Thomson's law are widely different. In fact, it will frequently be impossible to apply Thomson's law, as it will frequently occur that the interest on the plant, even when at its minimum cost, will far exceed the value of the energy wasted; and, evidently, if we depart from the condition of minimum first cost with an endeavour to increase the loss and thereby to make the value of the increasing loss in the line finally equal the interest on the increased cost of plant, since we are increasing both items, we evidently are not approaching a minimum value. CHART 3 clearly shows that, frequently, the curve of interest and depreciation and the curve of value of energy wasted will never cross, and hence will never be equal under any conditions of loss.

Formulæ (21) and (22) clearly show that no such relation can exist, and CHART 3 makes it evident graphically. *Example 11.* We find that by Sir William Thomson's law if the power is worth $20 per K. W. at generator brushes, and the interest and depreciation is 10 per cent., we should work at 22½ per cent. loss; whereas, in reality, for the maximum economy we should work at 10 per cent.

We also find that in all the seven other cases indicated by the curves it is impossible to apply Thomson's law, as we cannot, by any means, make the interest on capital outlay and the value of energy wasted equal.

Both Kapp and Ayrton and Parry have discussed Thomson's law and made certain limitations and modifications, but have only complicated, and not corrected it. In Mr. Badt's present work he refers to Kapp's latest formulæ contained in a lecture of March 2, 1891, a copy of which lecture I have not as yet seen; hence the formulæ quoted by Mr. Badt cannot be commented on by me further than that Mr. Kapp's formulæ as given by Mr. Badt point to one fact which is very evident from formulæ (13) and (21), CHART 1, namely, that under no circumstances will it be economical to lose more than 50 per cent. in the conductor, for when $E=2V$, we have $E-2V=0$, and an infinite cost of conductor as a resulting condition.

Practical Results in the Magnetic Concentration of Iron Ore at Croton, N.Y.

By W. H. HOFFMAN, M.E.

The ore is described as consisting of compact, moderately fine-grained magnetite in a gangue composed mainly of quartz and hornblende, besides feldspar, apatite and mica, and more or less pyrite and pyrrhotite. It is highly satisfactory that the grain of the ore permits a fair disintegration of its constituents by crushing it to pass a 12-mesh screen, inasmuch as a finer mineralization would increase the cost of concentration, as hereafter described.

The average metallic iron in the ore ranges from 37 to 42 per cent.; the sulphur from 1.7 to 2.2, and the phosphorous from 0.070 to 0.426. Practical work has shown the average phosphorous to be 0.232. Since May 1, 1891, we have been roasting and concentrating this material to 68 per cent. in metallic iron, 0.44 in sulphur, and 0.036 in phosphorus. Previous to this the concentrates ran about 66 per cent. in iron. The average of eleven analyses taken from the workings between June 6 and August 13, 1890, gives the following composition:

Metallic iron 40.64 per cent. Sulphur.. 1.540 per cent.
Phosphorus.. .302 "

Before the old water-jigging mill was erected some eight years ago, the product of these mines was sorted to remove the more sulphury ore, and was shipped directly to furnaces making foundry irons. In order to meet the requirements of purchasers the mining company was obliged to reject, in cobbing, 2½ tons to get 1 ton of shipping ore containing 51 per cent. of metallic iron and not more than 1 per cent. in sulphur. About 50,000 tons of this class of ore was shipped from these mines. The old dumps from this sorting are now being crushed and separated by the new process. Mr. John Birkinbine, in his paper on "Progress in Magnetic Concentration of Iron Ore" (*Trans.* Am. Inst. M.E., xix. 656), quotes from the private letter of a member of the Institute an expression of emphatic doubt whether, at any American mine, it would pay to mine and concentrate a lean magnetite. The writer says: "So far as I can see at this stage of our practice, waste-dumps only, or the rejected portion of an output, other portions of which have been shipped at a profit covering the whole cost of mining, can be used as the raw material of concentration." I can assert, and prove beyond question, that the Croton mines have produced and sold at a fair profit from 50 to 220 tons of concentrates per day during the past year and a half; and the mill has been actually running but 20 months.

Commercial success in concentrating any ore includes economical mining, preparation and separation; but in the Croton ore the presence of sulphur calls for very economical roasting as well as economy in all the other processes. The cheap roasting of the ore, which contains about 2 per cent. of sulphur, was really one of the first problems encountered in reclaiming that property, and was as important a factor as the concentration.

A series of experiments was made to determine the best size for economical roasting, and at the end of three months a size that would pass through a 2¼-inch ring was adopted, as giving the most rapid work for the quantity of fuel consumed. Crude Lima oil is used for roasting. Through experiments we found the average consumption of fuel oil to be 3.75 gallons; but by enlarging the combustion chambers we have reduced this amount to a little over 3.6 gallons per ton of raw ore. The cost of the oil is 2¼ cents per gallon, making a fuel cost of 8½ cents per ton of raw ore. The labor of filling and discharging amounts to only 3 cents per ton, as this work is largely automatic. The average temperature is 1,250° Fah. Davis-Colby roasters, remodelled to burn fuel oil, are used for a portion of this work, the remaining portion being done in a roaster of new type designed by the writer. The Davis-Colby roasters have been in operation nearly three years and have done excellent service.

The ore is conveyed automatically from the roasters to the Sturtevant mills, where it is ground to 12-mesh size, all coarser material from the screens being returned to these mills by elevators. Barring the numerous experiments with the various types of magnetic separators, the experiments in crushing have been the most elaborate. Nearly all the best-known methods of grinding ores have been tried during the past three years. Some of these machines have been tested for a year or more, but about 15 months ago we became thoroughly satisfied that the Sturtevant mill was far superior to any other machine for *grinding* iron ores. I consider it necessary to mention this machine thus somewhat prominently, as its economical and uniform granulation plays an important part in answering the question in Mr. Birkinbine's paper: "Does magnetic concentration pay?" If the ore is not properly granulated and screened, no known method of separation or concentration can make it a commercial success.

The screen-block openings in the Sturtevant mills are ¼ inch wide, and the coarsest material passing through them is less than 7-32 of an inch thick, while the finest material would be rejected by a 60 mesh screen.

The ore enters the Sturtevant mills at a temperature of about 350°, being cooled from about 1,200° by a water bath on its way up the conveyor. Under these conditions the ore is quite friable, and we have no difficulty in grinding 22 tons per hour with the 20 inch mill, and 16 tons in the same time with the 15 inch mill. One set of Sturtevant mill bushings will grind from 4,000 to 6,000 tons of ore, according to the depth of the chill in the bushing, the cost of each set being $16. The screen blocks for this amount of ore cost $9. This is less than one-half the cost of renewal on any other machine formerly used at our mill. At 22 tons per hour the 20 inch mill requires 94 horse power to drive it, but it will be remembered that the product is finished on these mills. The 15 inch mill requires 70 horse power. The ground ore is elevated from the discharging nozzles of the Sturtevant mills to the several screens, covered with slotted steel plates. The slots are 1-12 by ½ inch in some plates, and 1-12 by ⅜ in others.

The slotted plates are easily removed, and when the requirements are exacting as to phosphorus, we substitute plates of 1-14 mesh on two of our five screens. We have demonstrated by exhaustive experiments that two sizes of screen-plates, three sets coarse and two sets fine, will prepare the ore containing 0.426 in phosphorus (the greatest amount we have in the mine) for a separation having 0.036 with two passes on the magnetic separators. Ordinarily, the phosphorus runs from 1-10 to 3-10. When it runs higher than 6-10 three sizes of screen plates should be used, delivering to three receiving bins, and each size should be treated separately on the magnetic separators; and I am positive that this treatment will insure a Bessemer product running not over 0.050 in phosphorus, using nearly any of the New York State magnetites that are free from titanium. In some experiments we have used 18 mesh screens, and with ore prepared for this grade we were enabled to produce continuously, with two passes, concentrates showing 70.60 metallic iron, 0.018 phosphorus and 0.220 sulphur. Of course the silica was extremely low. With the latest Hoffman separator, using 12 mesh screen, and making two passes, we have produced concentrates showing 70.93 metallic iron 0.017 phosphorus and 0.231 sulphur; and by using 18 mesh screens we can depend on 71 per cent. concentrates with one pass on this machine. The screens deliver their finished product to two bins placed on the floor above the separating department, each having a capacity of 80 tons. Eight shutes deliver the ore to the separators, nine in number. On eight of the machines the ore is passed before the magnets twice to bring the loss in tailings to 8 per cent. I have lately designed two new separators, one of which is giving with one pass, concentrates of 68 to 70 per cent., with a loss of only 6½ per cent. of iron in the tailings. As patents are now pending, these machines cannot be described here. People frequently ask how much it costs to separate the iron ore from the gangue. We always reply as little as any other portion of the process. Seven cents per gross ton of concentrates is a liberal allowance, and this includes all repairs to separators. We shall reduce this to less than six cents soon. Repairs and supplies throughout our milling plant amount to one and eight-tenth cents per ton of raw ore ground. Hence, it will be readily seen that *the* feature of the problem of magnetic separation is the initial mill grinding or granulating.

Using Sturtevant mills, and 22 per cent. ore, we can pay a small profit at our plant. Crushers and rolls require 28 per cent. ore to pay at the present price of concentrates. We contract our mining and initial crushing ready for, and delivered to roasters, at an average price of $1.38 per cubic yard. The ore weighs from 5,500 to 6,800 pounds per yard. We are selling concentrates at present to six furnaces, which use from 35 to 53 per cent. of them in their regular mixture. The furnacemen tell us that their flux and fuel are reduced, but most of them decline to give the exact amount. We have yet to receive a complaint from any of our customers as to quality or fineness. I have personally witnessed the use of several hundred tons of our concentrates at the experimental Ramel Conley steel works, near our mines. They were used in the various ways; sometimes loosely thrown into the bath, and at other times made into briquettes and charged in the open-hearth furnace along with the piles of scrap or African ore. Every one of the practical open-hearth melters employed there at different times has informed me that he was surprised at the rapidity with which he could handle the furnace when using concentrates.

An accurate, though condensed, statement of the cost of mining, crushing, roasting, preparing and separating, one gross ton of 68 per cent. concentrates, from two and one-fifth tons of 38 per cent. ore, according to the present daily practice at the mines, is given below. The tailings run, in iron, from 7 to 8 per cent. About one-third of the ore is taken from the old dumps. On the basis given below, 580 tons is crushed every 20 hours, with a production of about 265 tons of concentrates in the same time:

Statement of Cost.

Mining, crushing and delivering to roasters, 2 1-5 tons of raw ore, at 2¾ gross tons per yard..	$1.13
Roasting, including top filling.	.23
Handling at roasters..................	.03
Preparation at screening......................	.22
Daily renewals, supplies and repairs of all machinery and roasters........................	.05½
Separating, including labor and power..........	.07
Deliv'y to Harlem R.R. switch, includ'g R.R. repairs	.04
Office and laboratory expenses..................	.04½
Insurance, interest and taxes on plant..........	.13
	$1.95

During the last winter and spring, a continuous run of five months was made of twenty hours each day, and the average cost of a gross ton of concentrates for the whole term was $2.10. Improvements have reduced this amount to the figures of $1.95, given above.

The following analyses cover an average two weeks shipments in July, August and September of the present year. All concentrates were from screens with slots 1-12 x ½ inch, and all samples were from carloads:—

	July 7.	July 15.	Aug. 27.	Sept. 5.
Metallic iron..	68.55	68.080	68.250	70.090
Phosphorus...	.0365	.0368	.030	.045
Sulphur.....	.240	0.340	.475	.170
Silica........	3.500	3.610	2.951	2.513

Trans. Man. Geo. Soc., Part X., Vol. XXI.

To illustrate Mr. Sutcliffe's Paper.

SINKING MACHINE.

Fig 1

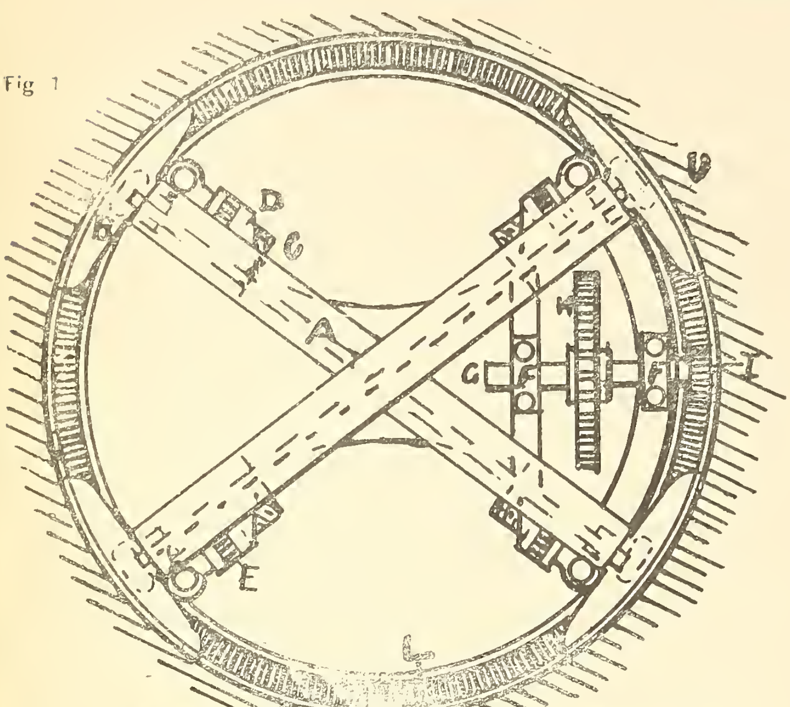
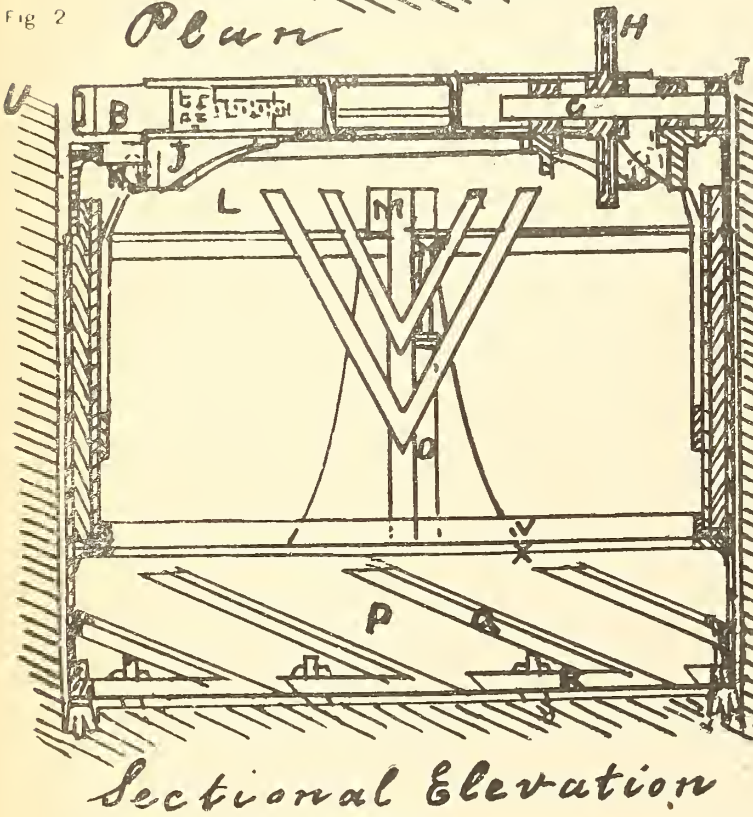


Fig 2



WALLING APPARATUS.

Fig. 3.

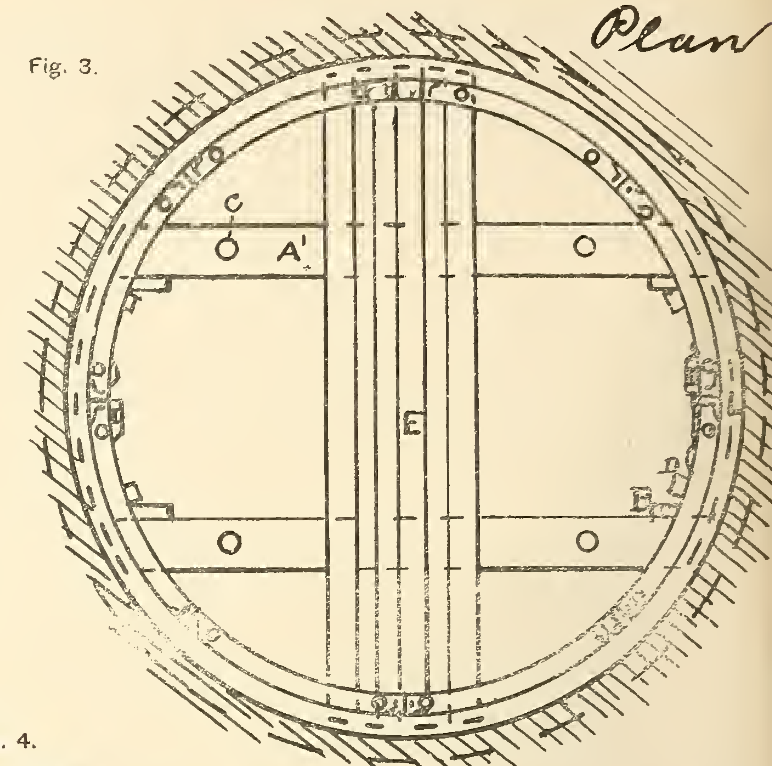
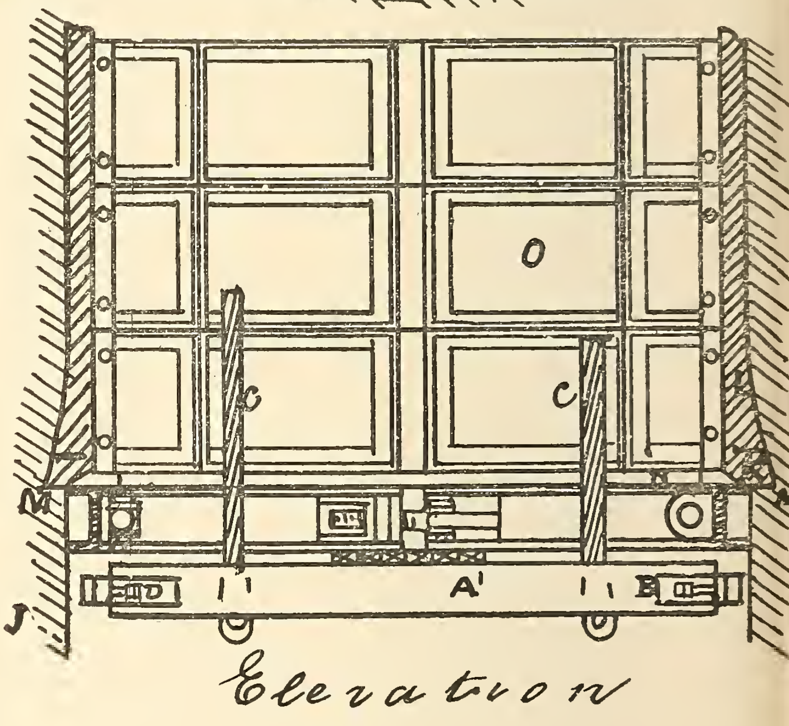


Fig. 4.



A Sinking Machine and a New System of Sinking Pits.*

By R. Sutcliffe.

[Having seen that a number of colliery owners all over the country proposed sinking new pits, most of which are intended to reach a very considerable depth, and therefore must occupy a long period of time before winning the coal, I began to study and enquire in my own mind to see if there was no means of improving the slow method of sinking which at present prevails, and I came to the conclusion that it was quite easy to devise a more speedy, safe and cheaper system by the adoption of machinery instead of hand labor, and by replacing the present practice of sumping in the middle of the pit by what I think to be a more rational mode of cutting out or setting free the layers of strata all round the pit bottom in advance of the sinking. To accomplish this I have designed and patented a machine as shown in position within a pit, and ready for work, but without the motive power in the accompanying drawings. This machine can be worked by means of compressed air, electricity or such other motive power as the user may decide to adopt, but I prefer the former (compressed air) on account of its cooling effects on the pit bottom, as well as its general utility in a mine. I need not stop here to point out the many and great advantages of having the walls or sides of a pit cut in the solid to the exact size required, and left smooth and even and perfectly circular, instead of the rugged and uneven walls too often seen in our best made pits.

The sinking machine (figs. 1 and 2) consists of:—

1. A frame of steel or iron girders, A, firmly secured together with angle brackets at the centre and cross-girders at one end, to carry bearings F and F, which takes the driving shaft G. Four shoes, B, are fitted, one at each end, to the girders A, and allowed to slide freely on the same to the extent of two or three inches, and having a flange at each side of the webs of the girders. Brackets D, are also secured to the sides of the girders near the ends, and these brackets contain two flanges each, between which flanges a nut E, fits and is worked by means of a ratchet, etc., and in these flanges are suitable holes through which a screw, C, passes and is coupled, as shown, to the shoe B, at each end of the girders.

2. The air engines, or their equivalents (not shown on the drawings) are fixed on the girders A, so as to gear into the cog-wheel H, which is keyed on the shaft G, as is also the pinion I, which meshes or gears into an annular rack, L, and rotates it when the engines are set in motion. Size of engine cylinders, about 8 inches by 12 inches.

3. An annular rack L, composed of four or more pieces for convenience in handling, and with which is cast a vertical flange or shroud, about 2 feet deep and 1 inch thick, to take guides, M, and their strengthening stays. To the under side of the girders A, are secured four strong brackets, J, one at each end, fitted with journals, which carry runners, K, upon which runners the annular rack travels, carrying with it the whole of the under portion of the machine.

4. A cutting barrel or cylinder, P, composed of eight segmental steel castings, four of which are extended upwards to take slides which work within the guides M, and also the pistons of hydraulics, O. On the under end of the cutting barrel are cast tool boxes or sockets, R, to hold cutting tools, S, and on the internal side of the barrel are spirally placed ribs, Q, at frequent intervals, which serve to keep the groove or annular channel clear of broken earth or debris by scooping out the material, and they also assist to preserve the rotundity of the barrel by strengthening it. Also for the latter purpose an interval flange is placed at the top of these ribs.

5. Four hydraulics, O, for the purpose of regulating the feed and withdrawing the cutting barrel from the groove cut, or to lower the girders, A, and their connections for a fresh cut.

When the machine (figs. 1 and 2) is being made ready for a cut, the girders A, are securely and firmly fixed in a horizontal position by pressing the shoes B, (which are packed with wood to increase friction and absorb vibration) against the sides of the pit, U, by means of the screws C and nuts E, care being taken that a small space is left between the annular rings V and X, in order that the weight may be lifted off the cutting pieces. S, before starting the machine. And when working, it should be allowed to feed as it cuts. When out to its full extent the shoes should be released from the pit sides and the upper portion allowed to descend either by means of the hydraulics or the capstan rope, on which the whole machine may hang. Small flexible tubes are conveyed from a small plunger fixed at the engine to the hydraulics so as to be able to work them from the engine when desirable, instead of by hand. The girders in this machine are arranged to allow two sinking buckets to pass (one on each side), but where it is desirable to have only one sinking rope near the centre of the pit, the girders can be placed parallel and kept sufficiently apart.

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* Paper read before the Mining Institute of Scotland.

Assuming this machine to have 20 single and 20 double cutting pieces acting at same time in the groove, and making one revolution per minute in the pit bottom, it should cut at least 30 inches per hour in ordinary sinking stone, and, with the stone set free all around, layer after layer can be filled away without any powder. Sheet iron shields are allowed to hang from the stationary girders A, to protect the workmen from the rotating portion of the machine.

When it is necessary to cut a walling bed, special cutters are secured to the machine, and these cutters expand outwardly as the cutting barrel descends from the annular rack. In order to expedite the raising of the sinking material, I adopt the use of guide ropes, and utilize them in the following manner: Suspended on four guide ropes C^1, (figs. 3 and 4, Walling Apparatus), are two parallel beams of timber, A^1, tied together at each end by iron plates B^1, in which are fixed four set screws, D^1, which press against the sides of the pit in order to steady the guide ropes and beams in their proper position. On these beams are secured flooring deals E^1, so as to cover the whole of the pit except the openings required for the sinking buckets, air pipes, etc., in order to facilitate working thereon and to afford additional protection to the sinkers underneath to that supplied by the special walling scaffold to be used in putting in the walling simultaneously with the sinking. For the walling or lining of the shaft I employ concrete, and to do so I place on the flooring deals, above referred to, a temporary walling crib, composed of iron or steel and made in four pieces or segments, which are connected together by four bolts or screws and nuts, with suitable brackets, as shown on drawing (figs. 3 and 4). The top of this temporary walling crib is placed on a level with the wall bed or annular step M^1, and there expanded by the screws or bolts and nuts until made securely fast from pressure against the sides of the pit, when segments of wood, N^1, are placed upon it in order to facilitate the closing of the next lift below to be afterwards put in underneath. A course of bricks or blocks with quick setting cement or a low course of rich concrete, K^1, is next set, partly resting on the annular step out for walling bed and partly on the temporary walling crib. On the inner side of the wood packing N^1, is next placed a circular course of casing O^1, composed of angle iron frames lined with corrugated sheet iron (having the undulations placed horizontally), in eight segments, of a height of three feet, bolted together and having a wood packing piece R^1, in one vertical joint of the course to facilitate the withdrawal of the same. The freshly made concrete is poured in behind this casing, taking care that it is properly placed and packed all around by a careful hand and suitable utensils, and when filled and packed to the top, another course of casing is placed on the first and filled in at the back with concrete in like manner, and so on, placing course upon course, and fitting them with concrete at the back, until the bottom of the lift of lining or walling above is reached and closed up. When the lift or walling to be put in is a long one, the annular steps might be cut at intervals of from eight to twelve yards, so as to distribute the weight of the walling on the surrounding strata for extra security, instead of allowing it to rest entirely on the material composing the lining of the pit. It will be at once seen that a short time suffices to allow the withdrawal of the temporary walling crib, when it can be lowered with the guide ropes and re-set for another lift of walling, leaving the corrugated casings in position above (secured by undulations in the lining) until required for the fresh lift, when they can be brought down and re-set at the same time as the sinking proceeds.

In conclusion, I may say that I expect and believe that six yards per day of three shifts can be sunk and lined as safely and as easily as the amount now attained in ordinary sinking.

MINING NOTES.

[FROM OUR OWN CORRESPONDENTS.]

Nova Scotia.

Cumberland County.

The Springhill collieries continue to flourish. Though the output was somewhat reduced owing to the fearful explosion in February, it is again up to 1,600 tons daily, from three slopes. Just now 1,460 men and boys are steadily employed, and shipments by rail and water are large.

Judging from the extensive improvements and alterations made this season, it is the intention of the management to equip these collieries with the most approved appliances for the mining and handling of an enormous output. At least thirty thousand dollars—probably more—has been expended on new buildings and machinery this season, besides expensive improvements underground, the cost of which it is difficult to accurately estimate.

The new bankhead building at No. 2 slope, is the most conspicuous improvement It is nearly finished and will cost about $6,000. The bankhead is horse-shoe shaped. As the boxes are hoisted from the slope they will run round a sharp curve to the screens. This building is 360 feet long, 30 feet average width, increasing to 42 feet at the screens. It is built on a trestle work 30 feet high, and the 12 foot post of the building gives a total height of 42 feet. There are five well laid tracks of steel rails, 40 lbs. to the yard. Two tracks are elevated, and over these the empty boxes will be conveyed by an endless chain to the pit head. The loaded boxes will also run by gravitation to the screens. There are six coal chutes, 54 feet long and 5 feet wide. As the coal runs down, it passes over longitudinal bars fifteen feet long. Two chutes are arranged for loading closed box cars, and the other four for ordinary coal cars. The old building is to be demolished about 15th November, when the new one is expected to be in readiness.

No. 2 slope has been sunk an additional 1,100 feet, making the total depth 3,000 feet. The seam is 13 feet thick, of superior quality. The levels at the 3,000 ft. lift are now driven over 3,000 feet, and the coal is taken through a tunnel and hoisted up No. 1 slope. Hoisting from the lower lift up No. 2 slope will begin in about a year. At present the coal all comes from the 1,300 foot level. The underground workings have been greatly extended. The slope has been re-timbered. Old steel rails have been used as booms for supporting the roof. The slope has likewise been re-laid with steels similar to those already described, on the new pit head. The fan-way has been enlarged from 36 to 80 feet area, thus giving an increased circulation of air. At this slope 56,000 cubic feet per minute circulates at the bottom of the slope.

At No. 3 slope six new tubular boilers, built by John McDougal & Co., Montreal, have been placed in position. These boilers are 30 feet long, 5 feet diameter. The additional power is required for driving a powerful pump, and the tail rope system is shortly to be introduced.

The new pump was built at Jeansville, Pa., and was selected by the mechanical foreman in charge, Mr. George Hall, after a personal inspection of the various pumps in use at the best equipped collieries of Pennsylvania. The water column pipes are 12 inches diameter, lined with wood, and were specially imported to resist the corrosive properties of the pit water here, which is most destructive to iron. The pipes are laid on the travelling slope which has been widened three feet a distance of 1,300 feet. The underground pump house, in which the new pump is to be placed, is 50 feet long and 15 feet wide. The walls are of solid masonry, three feet thick, and it is arched with brick. It is said to be one of the best on this continent.

At this slope the fanway has also been enlarged, giving a seventy foot area. The levels have been extended and pierce the workings of an abandoned slope one mile distant, for ventilating purposes. The slope has been put down an additional 600 feet, which gives a depth of 1,900 feet. The work of sinking has been carried on at all the slopes by means of bore-holes, and engines placed on the surface. These holes are five inches diameter and were bored by oil well borers from Ontario. The long-wall system is being worked very successfully in No. 3 slope in a four foot seam.

No. 1 slope—the seat of the explosion—has been sunk 700 feet, and will soon be hoisting from the 2,600 feet lift. Two boilers have been placed to give additional power for this purpose. Underground the workings have been extended a considerable distance. The two balances in which the explosions occurred will soon be stripped of all pillars and abandoned. These balances and the bords connected therewith have always been dry and dusty. No powder has been used in any of the slopes since February, and safety lamps are used exclusively in all the pits except a part of No. 2 slope. The "Marsant" lamp is preferred and 1,000 of these are in use.

Alexander McInnes, formerly assistant manager, was promoted at the time of Manager Swift's death. All underground work is under his supervision. His assistant is Chris. Hargreaves, and the underground managers in each slope are Wm. Conway, No. 1; George Wilson, No. 2; Wm. D. Matthews, No. 3. The general manager of the company is J. R. Cowans, of Montreal, who resides here.

Beaver Dam.

This promising district, besides lying idle nearly all summer, is to remain unworked this winter. It is understood that one or more attachments will be made for reasons private to the company, and next summer may see the property working under new ownership.

Dufferin.

The quartz of this company has been very low grade all summer, but is reported to be looking much better of late. The mill continues to give great satisfaction.

Montague.

The new ten stamp mill of the New Albion Co. was started on the 7th inst. The batteries and iron work are from I. Matheson & Co., New Glasgow. The mill is well built and solid. Some very fine specimens were taken from the mine this month. It is understood that this property with an adjacent one is now being floated in London. Other properties in the district are idle.

North Brookfield.

The mine, which was sold at public sale in August, for something over $4,000, is now being unwatered preparatory to working. The syndicate which now controls the property has several practical miners in it, and the future of the mine looks prosperous.

Oldham.

It is reported that the Baker mine of the Oldham Co. will soon be closed down owing to poor grade of quartz. The mine is now 420 feet deep in a nearly vertical direction, and has been opened for a considerable length disclosing reserves which unfortunately are too low grade to pay.

Oxford.

Owing to a disagreement between bondholders and shareholders, two attachments have been placed upon the property of the Oxford Co. and the mine has been closed. The difficulty is entirely factional amongst the shareholders and the company is solvent.

Waverley.

The Sophia Mining Co., after unwatering the Tudor lode, started to sink the main shaft for another 100 ft. lift, but the recent heavy rains have drowned the pumps and sinking is temporarily suspended.

The Lake View Co., after several years work, announced in July a closing down because the ore was too low grade to pay. Mr. Hayward, the superintendent of the company, has obtained a two years lease of the property, and reports good grade of quartz now being stoped. It is rumored that this company will amalgamate with the Windsor Junction company in a new organization to be floated in London shortly.

The property of the Nova Scotia syndicate, known as the Windsor Junction Co., has lately been examined by Mr. Alfred Woodhouse, an English mining engineer. In consequence of his visit, work on the Union lode has been discontinued, and a new programme has been arranged, the details of which comprise a vertical shaft to a depth of 500 feet. The sinking of this shaft will be watched with interest by the mining fraternity.

The West Waverley Co. have not yet completed their plant and report progress as slow. The air compressor from Canadian Rand Drill Co. is now being set up. The management fix no date for starting.

Wine Harbor.

The McNaughton Mining Co. suddenly closed down last month. As the quartz in stopes and shaft was looking as good, if not better than ever, the cause of stoppage is a query. Mr. Robt. McNaughton was the manager of the company, and he is now prospecting in Seal Harbor district, which reports a valuable find.

New Brunswick.

Coal mining is beginning to loom up again at Manners Sutton, N.B. There is a very good quality of coal to be found there, but it has never been ascertained as to whether it exists in any large quantities. A vein of 22 inches was struck at Cork, but nothing further was done. For years an old blacksmith got enough coal to run his forge at a place known as the Raer Settlement. It was a surface outcrop, and a pick-axe and a sledge were all the tools that he used. A license covering the ground has been secured, and a successful find may be reported in a few days.

Quebec.

There is absolutely nothing worthy of record from the Province this month. As our readers are aware, nearly the whole of the phosphate mines are shut down awaiting a better market and the removal of the Mercier tax, the only exceptions being the High Rock and Squaw Hill mines on the Lievres River and some development in the Templeton field. In the Eastern Townships, as noted last month, there will be on 15th November a universal closing down for the winter of the Asbestos mines. Some activity is still noticeable, however, in the production of pyrites at the Eustis and Nichols mines at Capelton.

Ontario.

Sudbury District.

The long looked for Report of the investigations into the mineral resources of this district by Dr. Robert Bell will be issued in a few days by the Geological Survey. An excellent map accompanies the Report.

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Halifax, N.S.

Mr. George Attwood, M.E., General Manager of the Dominion Mineral Company, sailed for England during the month. Mr. Attwood speaks highly of the district and its rapid development.

The Belmont Bessemer Ore Co., of New York, have done further development on their iron mine in Belmont Township and have uncovered a considerable amount of fine ore. They have a few hundred tons ready to ship. They are, however, at present building a railway into the mine to connect with the Central Ontario Railway. Two miles of the branch railway is already completed and they expect to have trains running over it in two months. Over 100 men are employed, besides about 30 teams. As soon as the railway is built the Company intend to ship at least 100 tons of ore daily. They have laid out a village at the mine and have built a boarding house, office, boiler-house and machine shop, large stable, etc.

The magnetic ore deposits in Snowdon Township on the line of the Irondale, Bancroft & Ottawa Railway are being developed and are showing up good ore. These ores are particularly free from phosphorus, the analyses showing only slight traces up to 0.025 phosphorus. A shipment of 200 tons some time ago gave, by the analyses of the chemist at the furnace, 0.01 phosphorus. This ore is therefore suited to make the finest steel.

Port Arthur District.

Both veins in the Badger mine, (Porcupine), are producing well; the mill running full time, and the mine making regular shipments, About 75 men employed.

The Climax is a new mine now being opened up, adjoining the Porcupine. Two very promising veins have been discovered on this property, and are showing up well, producing good mill rock and high grade shipping ore. The owners are Port Arthur people, but, like all other good things, it is bonded to our American friends.

It is ascertained through a reliable source that the owners of the Climax mine have struck it rich in silver in the adit on No. 2 vein. They have recently given an option upon the property and now feel that they have offered it too cheaply.

The Silver Mountain East, have again resumed work with a small force of men. Reports say the results are encouraging.

The Silver Mountain West, is producing richer ore and in larger quantities than ever before; and making continuous shipments of high grade shipping ore. Everything here appears to be booming under the management of Capt. Rapsey.

Kingston District.

Mica in large crystals, white, and of tough, strong quality, has been obtained on lots 11, 12 and 13, of the south west Range, on the Colonization Road, in Abinger township, and on lot 7 in the 5th and 6th Concessions of Effingham township. On a part of the latter property, a large vein of quartz, said to be 20 feet wide, gives samples containing free gold. No milling test is yet reported.

Manitoba and North-West Territories.

Further confirmatory reports come from Edmonton, in the North-West, that coal has been found at Red Deer, on the line of the Calgary & Edmonton railway, and about half way between the two towns. It is said that large seams of coal are found within a short distance of the surface, and that its quality is fully equal to the best Pennsylvania hard. Hitherto the only hard coal found in Canada was at Banff, so that the importance of the reported discovery to British Columbia and the North-West Territories cannot be over-estimated.

The operations of Messrs. H. W. McNeil & Co. at the Banff collieries progress favorably. The company are getting out five or six carloads per day, and are in a position to double up their working force weekly. About 100 miners are now on the pay sheet.

In addition to the regular mining at Anthracite the company are proceeding steadily with their horizontal rock tunnel, which is being driven by an Ingersoll steam drill at a depth of 380 feet, with a view to reaching the overlapping seams of which there is infallible evidence from surface development.

The H. W. McNeil Company are also developing their property at Canmore. As the coal from this point will be largely used for locomotive fuel on the Canadian Pacific Railway, the railway company have contracted to take 100 tons per day. It is also most valuable for smelting purposes, coking and general steam use. The C. P. R. are building a siding of 6,600 feet on the south side of the Bow to the pit's mouth, joining the siding into the Cochrane mine, the bridge over the Bow being common to both. There are 25 seams of coal here, varying from 22 feet down, the Jumbo vein being 22 feet thick. The White Man's Pass, directly opposite Canmore, is known to everyone who has been there as abounding in great coal seams. The McNeil Company are working a seam of 6 feet of clear coal and will be ready to ship before the C. P. R. siding has been finished. By the first November they will be producing 150 tons per day, of the finest quality.

The system adopted for carrying the slack from the breaker at Anthracite, is a perfect arrangement. A trestle 150 feet high is constructed with a tramway running up to the top at an angle of 60 or 70 degrees. The car is carried to the top by an endless chain worked by steam power, and it is so constructed (with a raised triangular bottom) that on reaching the top, by the pressure of a lever, the sides swing out and the car unloads itself and returns to the breaker. The estimated saving in this operation by steam is about $10 per day. The one engine runs both the breaker and the tram car. Another valuable contrivance is a double cable from the breaker to the mouth of the slope, which carries the loaded car to the breaker and the empties to the mine, dispensing with the use of mules and all manual labor. This cable is a quarter of a mile long.

British Columbia.

A meeting of miners was held in the School House, Golden, on Saturday evening, 3rd inst., for the purpose of discussing the operation of the new Mineral Act, particularly in reference to the staking of claims. The prevailing opinion was that claims should be staked out so as to give the miner a claim 1,500 feet long and 1,000 feet wide. The question of allowing a discoverer a square of 40 acres was also discussed pro and con, the objection being that by giving so much surface other lodes than the one originally staked might be included and thus seriously interfere with the operations of others. The *Era*, commenting on this point, says: "This in one way looks reasonable, but considering the fact that the country has an unlimited area, and that all share and share alike in this scheme, it is hard to see why any objection should be raised to such a simplification of the present difficulties. The Government may say that such a grant would be out of place, but they should remember that the miner and the State are one and the same; the benefit of the former would eventually be the advantage of the latter, in the revenue which could be derived from the country through its mines, by the momentary sacrifice of a little land which is virtually unproductive at present."

The bores now being put down on the New Vancouver Coal Company's estate, Nanaimo, are progressing satisfactorily. The Harewood bore is down 150 feet; the one near the beach, at Departure Bay, is down 500 feet, and the one in Mountain District, between Northfield and Departure Bay, 250 feet. The electric plant in No. 1 shaft is now in good working order. The plant is an expensive piece of machinery, costing in the neighborhood of $50,000, and by the time it is introduced into all the mines in conjunction with coal cutters and electric lights, it will cost the company about $150,000. So far no contract has been made for the latter, but it is thought it will shortly be arranged. There will be three motors to the present plant, and it is anticipated it will prove a great success.

The coal shipments from the Province for the month ended 30th ult., have been:

New Vancouver Coal Co.	25,464 tons.
Wellington Collieries	21,401 "
East Wellington Collieries	2,968 "
Union Colliery	9,490 "
Total tons	59,323

◆

Phosphate Shipments from Montreal.

The following are the official returns of the quantities of Canadian phosphates shipped to Europe from the port of Montreal from September 16 to date:

DATE	NAME OF VESSEL.	DESTINATION.	SHIPPERS.	TONS.
Sep. 16	SS. Amarynthia.	Glasgow.	Lomer Rohr & Co.	160
16	Bk. Sabrina.	Fleetwood.	Millar & Co.	50
19	SS. Bede.	London.	"	100
19	" "	"	Millar Rohr & Co.	150
21	" Pickuben.	Hamburg.	McRae & Co.	110
26	" Storm King.	London.	Anglo-Con. Ph. Co	150
26	Ship Tobique.	Liverpool.	Irwin & Hopper.	405
30	SS. Concordia.	Glasgow.	Lomer Rohr & Co.	100
Oct. 6	" Lake Nipegon.	Liverpool.	Wilson & Green.	42
7	" Alcides.	Glasgow.	Lomer Rohr & Co.	120
17	" Canopus.	Liverpool.	Wilson & Green.	501
17	" Amarynthia.	Glasgow.	Lomer Rohr & Co.	170
				2058

SHIPPERS' RECAPITULATION.

	Tons.
Lomer Rohr & Co.	700
Wilson & Green	543
Irwin, Hopper & Co	405
Anglo-Continental Phos. Co.	150
Millar & Co.	150
McRae & Co.	110
Total shipments to date	2058

RECAPITULATION OF EXPORTS.

	Tons.
Liverpool	948
Glasgow	550
London	400
Hamburg	110
Fleetwood	50
Total tons exported	2058

CANADIAN COMPANIES.

Jeanette Mining Company.—Charter of incorporation has been granted to this company. Head office at Ainsworth, B.C. Capital stock, $500,000, divided into 500,000 shares of $1 each. Formed to explore, mine, mill, buy, sell, lease, bond and to do any other necessary work for the development of the mines which the company now own or may hereafter acquire.

Stadacona Silver-Copper Mining Company.—Formed to operate the Grizzly Bear mine. Capital $100,000, in $1 shares. Trustees: C. T. Dupond, P. C. Dunlevy, I. Irving, C. D. Rand, J. Grant, all of Victoria, B.C. J. E. Boss, Spokane Falls, Wash., owns half the stock. Houses have been built on the property, and three shifts are running a tunnel westerly from near the east end of the claim. The tunnel, which apparently is off the vein, there being practically no mineral in the face, is in about 80 feet.

The McNaughton Gold Mining Company.—This company has applied for a charter pursuant to the provisions of the "New Brunswick Joint Stock Companies Letters Patent Act." Head office, St. John, N.B. Capital $16,000, in 16,000 shares of $1. The object for which incorporation is sought is the mining, milling and developing of gold mining on the properties owned by the company. Directors: Robt. McNaughton, Truro, N.S.; J. G. Forbes, St. John, N.B.; A. C. Blair, St. John; A. Wishart, St. John, N.B., and J. D. Hazen, St. John, N.B.

◆

A new Boring Apparatus.—A Russian engineer, in Baku, has constructed a boring apparatus, the superior qualities of which, says *Iron*, are exciting great interest in the Caspian oil districts. It is worked by hydraulic power, the pressure being duly recorded on a manometer, and requires but one attendant. For exploiting the naptha, an 18-inch boring is made; for trial work a 6-inch boring suffices. The 18-inch boring requires 6,000 pounds of water per hour; the 6-inch only 1,000 poods, the water on leaving the apparatus being caught and re-used. This machine is capable of cutting through hard rock at the rate of 15 millimetres per minute. The stone borings, etc., are continually washed out of the hole by the outrushing water.

◆

Moore's Patent Hydraulic Pumping Arrangements.—One of Mr. Joseph Moore's patent hydraulic pumping arrangements has recently been put in operation, we learn, at Linlithgow, Scotland. The pump is capable of raising 300 gallons of water per minute, and is placed 400 yards down an incline at a vertical depth of 500 feet, the steam engine which drives it being on the surface. By Mr. Moore's arrangement, pump rods are dispensed with altogether. There are upwards of 50 pumps worked on this system in operation in various mines in Scotland, pumping from 20 to 500 gallons per minute from vertical depths up to 120 fathoms. We hope to deal more fully with this system in an early issue.

◆

Winding Engine at the Wingate Grange Colliery.—Illustrations are given in *Engineering* of a vertical winding engine recently constructed at the Wingate Grange colliery, Durham. The Lord pit is 110 fathoms deep, and two-deck cages, carrying two tons are used. In full work the engine is capable of raising 1,200 tons per day of eleven hours. The 10-foot winding drum is carried by girders immediately over the cylinder, which is 40 inches in diameter, and has a stroke of 6 feet. The distributing valves are of the Cornish hand-geared type.

◆

Compound Pumping Engine.—The *Engineer* gives a description, accompanied by a plate, of a large horizontal pumping engine, built for the South Staffordshire Mines Drainage Commissioners. The engine has 52-inch and 90-inch cylinders by 10 feet stroke. It works two 27 inch plunger pumps each 10 foot stroke, forcing to a height of 500 feet. The engine is provided with a surface condenser, through which passes all the water which is pumped. The pistons are connected to the cross-head by three piston rods, one for the high pressure, and two for the low pressure cylinders, and the pump rods are worked by the angle-lobs. The two rods balance one another, but provision is made for throwing one out of gear, in case of disablement, and arrangements are made so that the single pump can be driven.

◆

Guttapercha for Colliery Pump Valves.—At the Maybach colliery, Saarbrucken, the valve packing for the pumps consists of guttapercha, and this has now been in use for over five years without renewal. The pumps work at a pressure of 50 atmospheres, about 10 hours a day and at a speed of from 60 to 72 double strokes per minute. The guttapercha should not be too hard, and should wear evenly.

◆

Pumping Natural Gas.—Gas is now being pumped near Pittsburgh, from wells which, as far as pressure is concerned, had become exhausted. The experiments have shown that the gas can be pumped long distances through pipes of a size much smaller than those in use.

◆

Damping the air in Collieries.—At the Planitz colliery in Saxony, the air used for ventilation is caused to turn a wooden lap-wheel working in water. The flaps or blades are thus being continually moistened, and a portion of the moisture given up to the incoming air.

The Prevention of Overwinding.—Mr. Archibald E. Pinching, vice-president of the Mining Association of Cornwall, has written to a contemporary describing an ingenious contrivance for the prevention of overwinding, which was inspected by the members of the Mining Association of Cornwall at the Lens Colliery, Lille, during their recent Continental excursion. Mr. Pinching says: "While being shown round the surface works by the chief engineer and director-general, who combines both offices in himself, and watching the fine engines at work hauling the coal with wonderful rapidity from underground, I was electrified to see the gentleman in question—while a large engine was winding on and off a 36-ft. drum a cage containing six full tubs of coal and a cage loaded with men proceeding underground—motion the engineman away from the handle and make him stand quite clear of the engine—and from the expression of the man's face it was quite evident that this had not been rehearsed—and thus leave the powerful machine entirely to itself. Almost immediately a warning bell rang, and we became aware that a powerful automatic brake—which I afterwards ascertained was on the Westinghouse principle—had been applied to the engine, and the drum was visibly slackening speed. The engineman, however, was still told to remain where he was. Shortly after another bell rang, steam was completely cut off, and the cage drew up to its platform exactly as if the engine had been controlled by the most practised driver. The apparatus consists of an arrangement of valves, which come into play directly the cage reaches a certain point in the shaft, and if the engine should at that moment not be under control, immediately apply the powerful air-brake. This, however, allows the cage to proceed at a certain speed, but should another point in the shaft be passed and the engine be still out of control, the brake is increased in power, steam entirely shut off, and the cage brought to a standstill. The arrangement imperfectly described above is the invention of M. Reumaux, who is the director-general of the society or corporation.

Production of Hollow Iron Spheres by Pressure.—A method which has recently been devised for this purpose consists in the use of a hemispherical mould and a similar die, a piece of sheet metal being first moulded, and then the sphere completed by removing it from the mould and reversing it, completing the moulding in the same mould. Frequent annealing is necessary.

Casting Solid Ingots.—Mr. W. R. Hinsdale has devised a method for casting solid ingots, which consists in the use of a mould of peculiar shape, so arranged as to chill the top of the casting, and then to turn the ingot upside down before solidifying.

Wire Ropes.—The principal causes which lead to the destruction of wire ropes are: the wearing away of the outer surface of the outside wires, the rubbing of the wires against one another, and fatigue of the steel, brought about when the rope is worked over pulleys relatively too small. Haulage cables for tramways wear out from the first cause, so that they may be made stiffer and the outside wires stronger, as they do not have to make sharp bends. Where small pulleys and sharp bends in the rope have to be used the rope must be flexible, and the experiments are chiefly directed to this point. The rope was strained over pulleys and reciprocated, the number of bends supported being counted. Tension and torsion tests of the wire used were also made. The failure of the ropes in all cases was occasioned by the individual wires gradually giving way, one by one. In no case were the outside wires severely worn even when the pulleys were so large that a great number of bends had to be supported. The principal stress to be regarded is that due to the bending of the individual wires and not that due to the load. The cutting of the wires where they cross each other, due to their longitudinal motion, accounts for the short life of ropes on small pulleys. The great effect of this factor is seen in the tests of Lang's lay of rope, which undergoes a much greater number of bends than the ordinary lay. Oiling, also, by reducing the friction due to the longitudinal motion in the rope, has a great effect in lengthening the life of the rope. The results obtained in the course of the experiments are fully tabulated.

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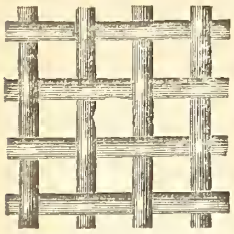

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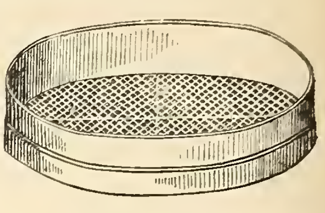

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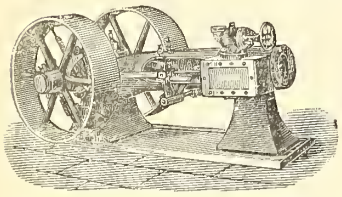

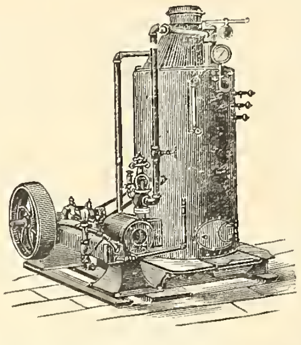

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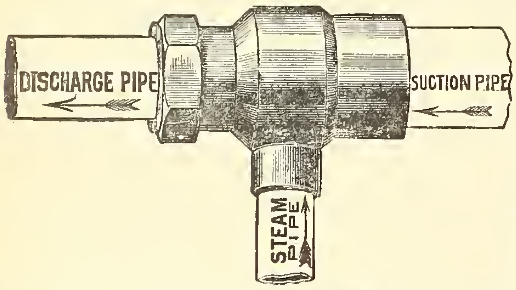

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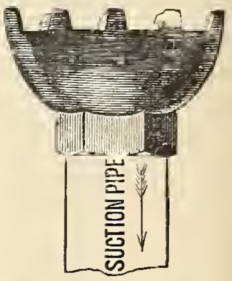

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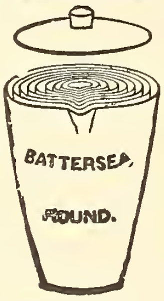

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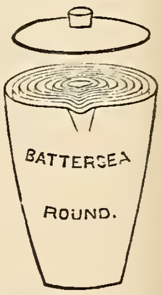

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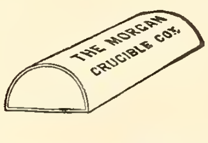
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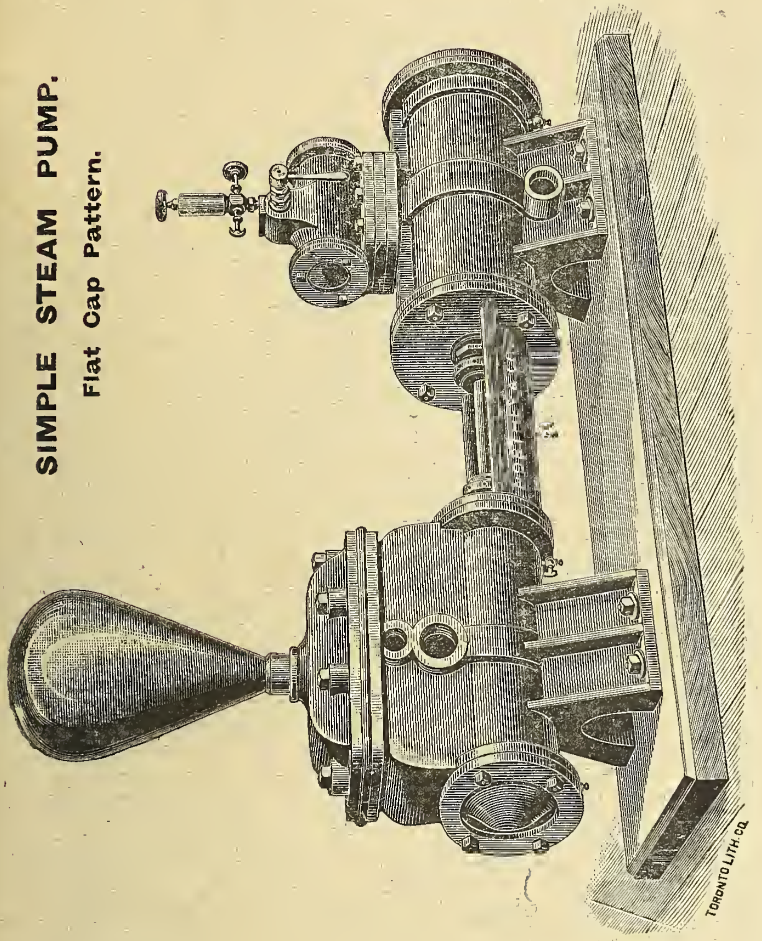
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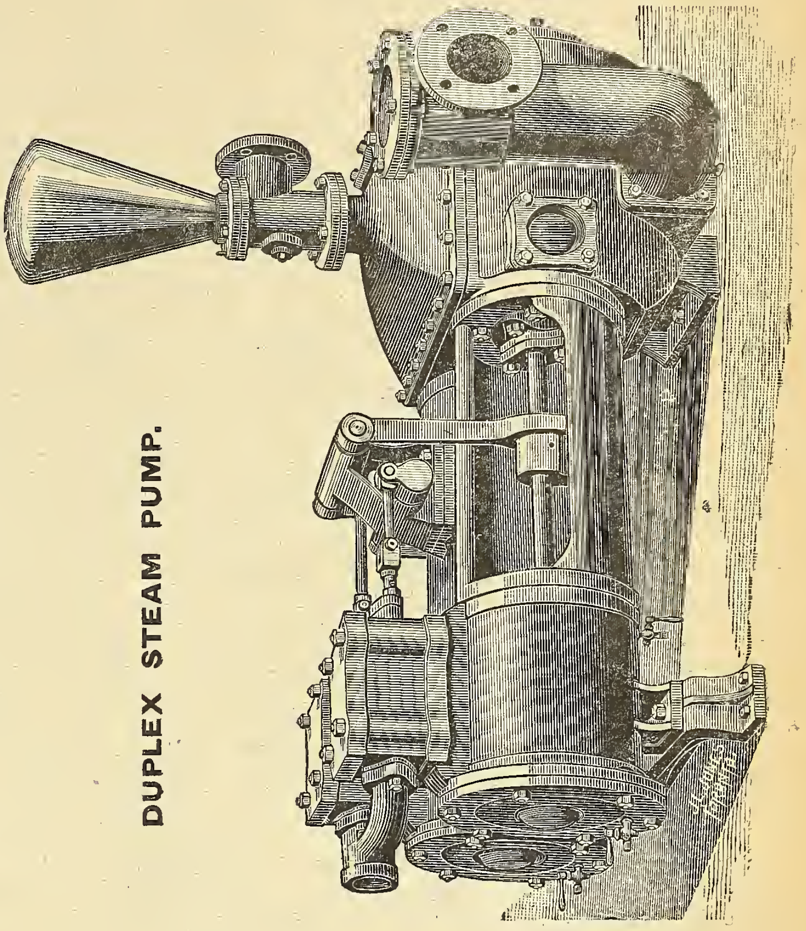

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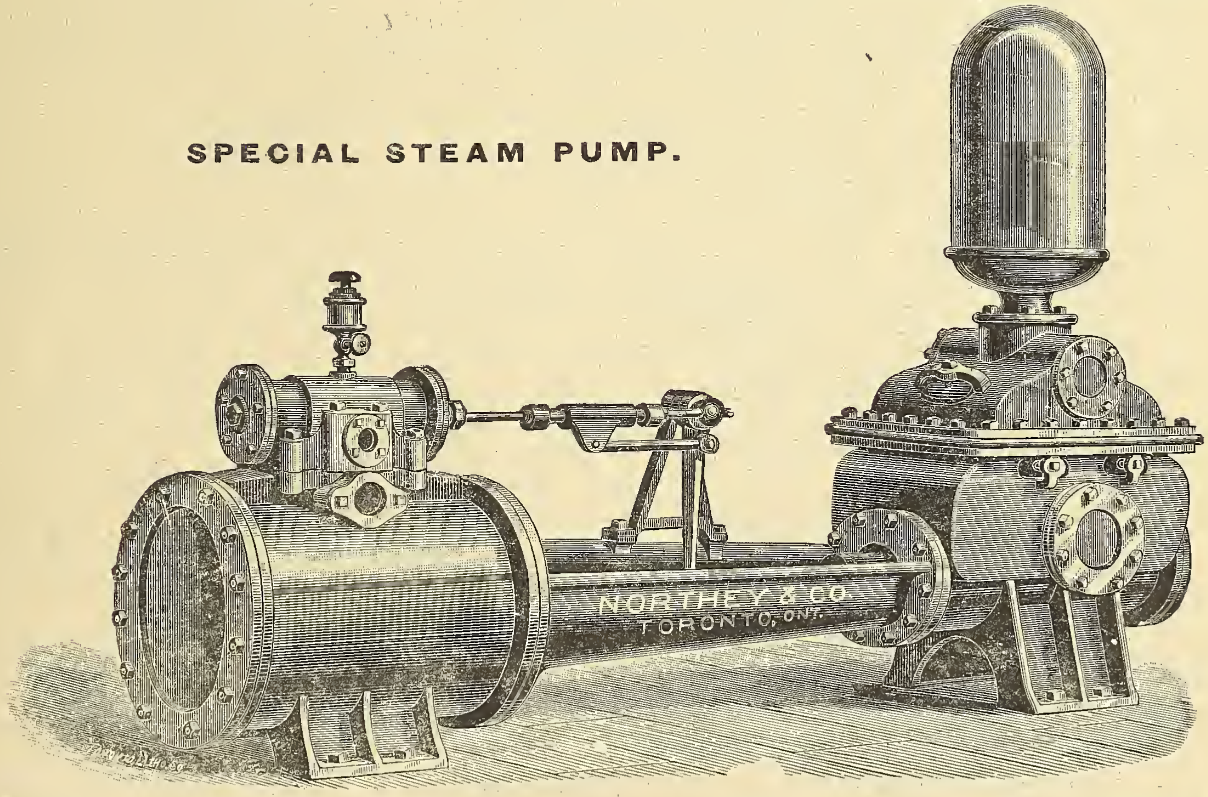
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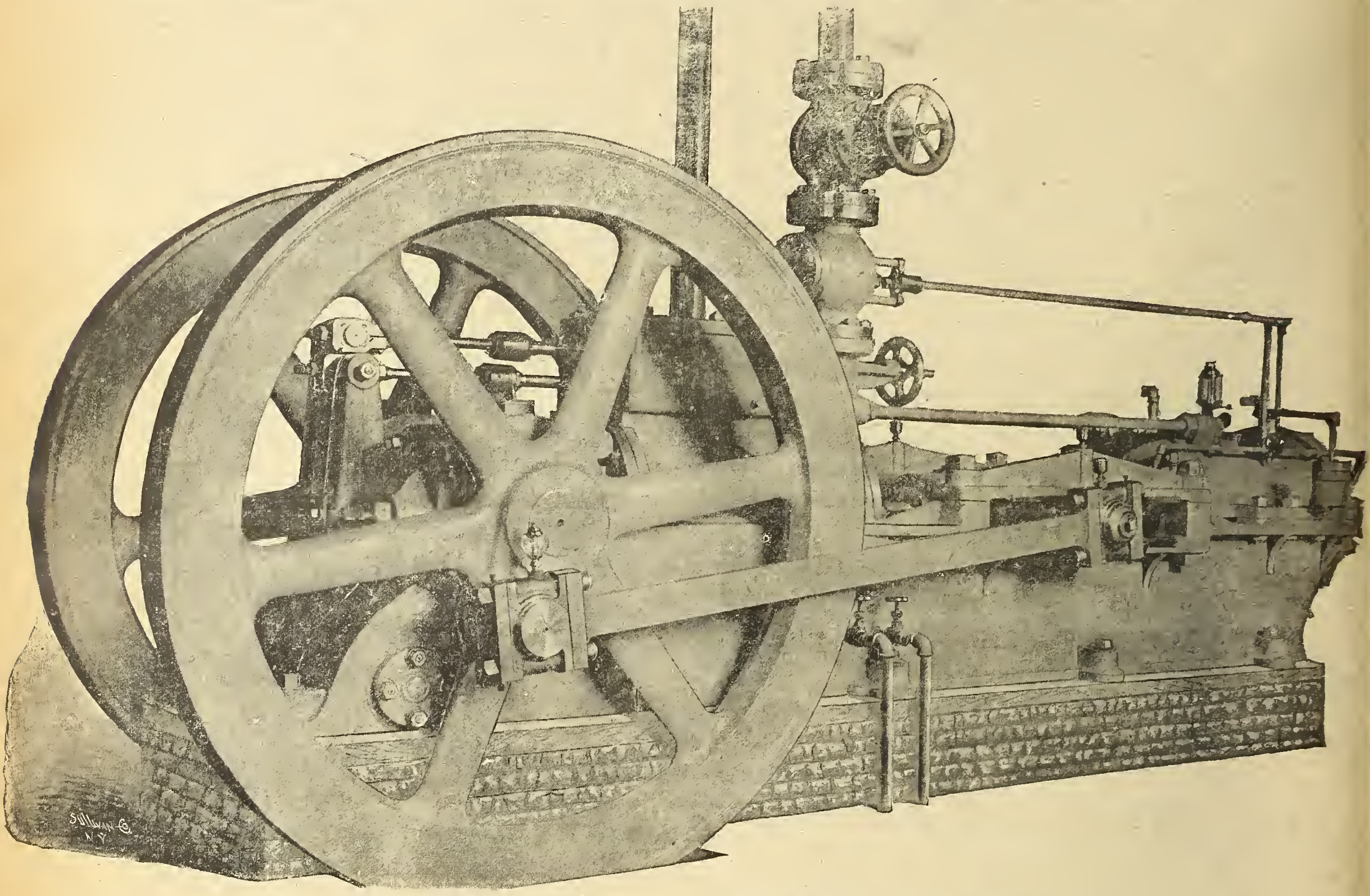

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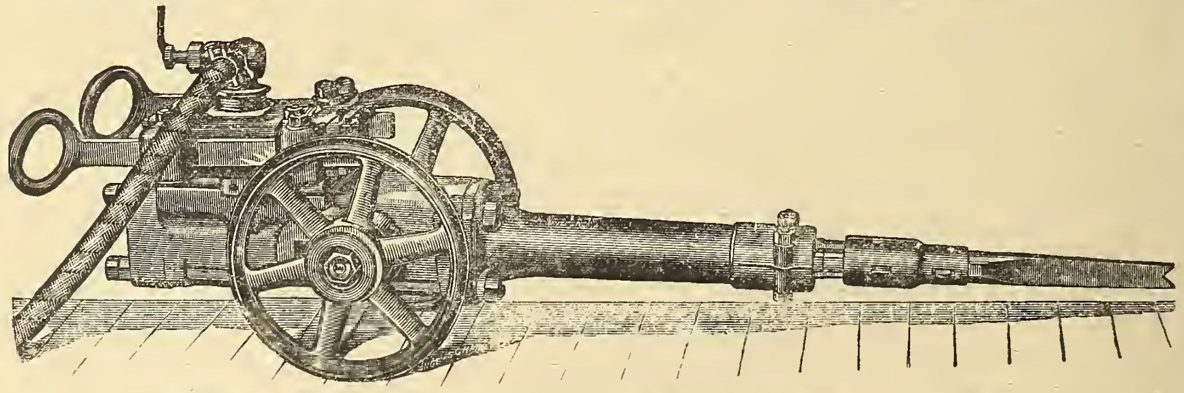

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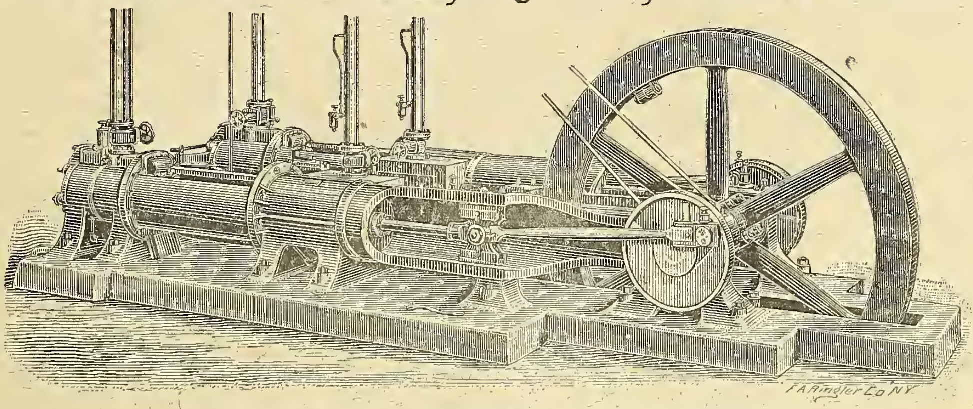

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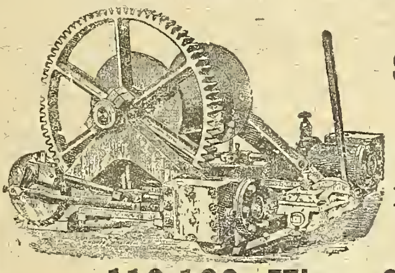

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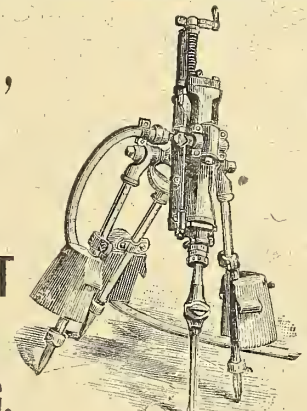

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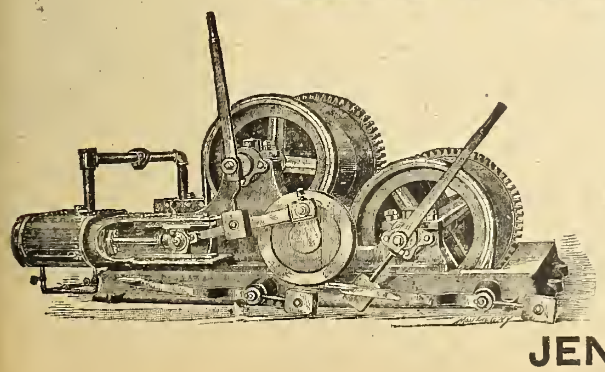

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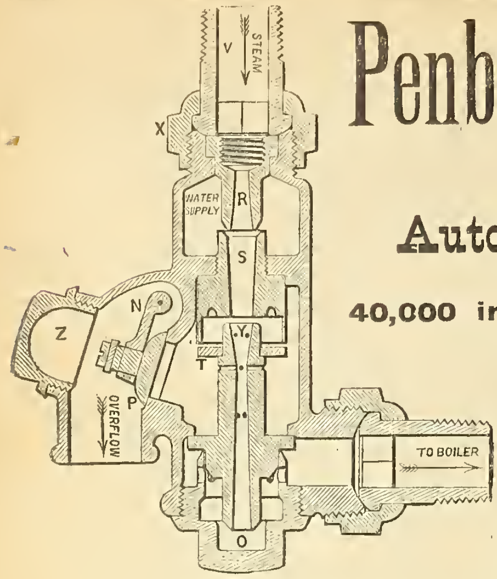

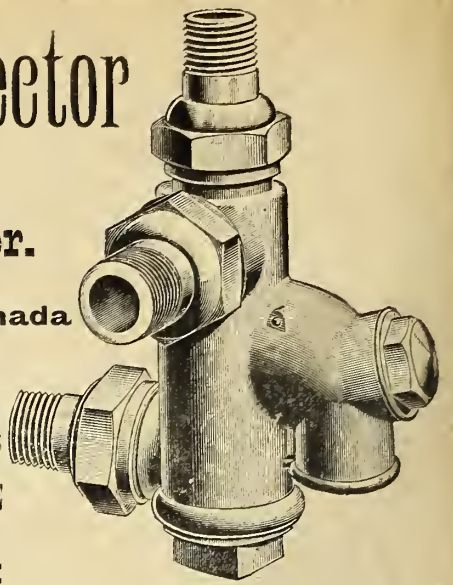

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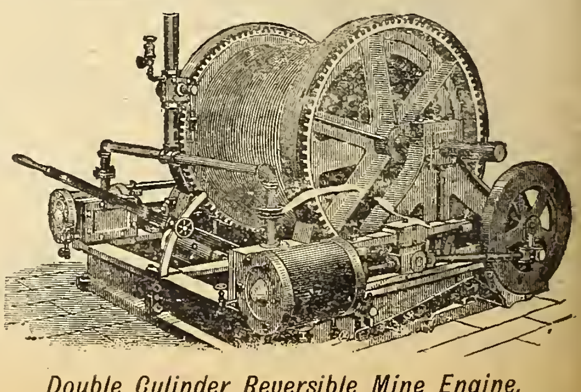

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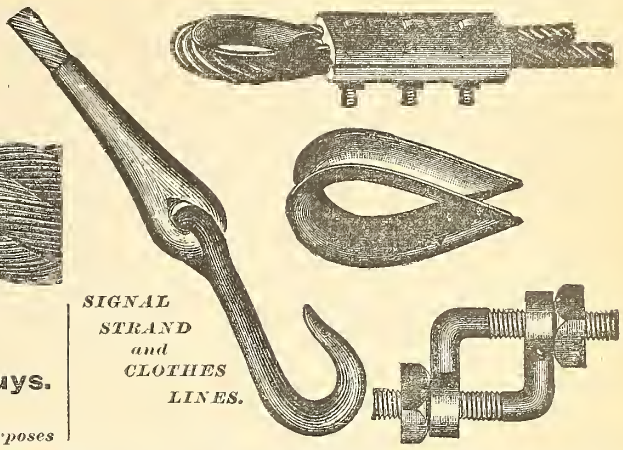

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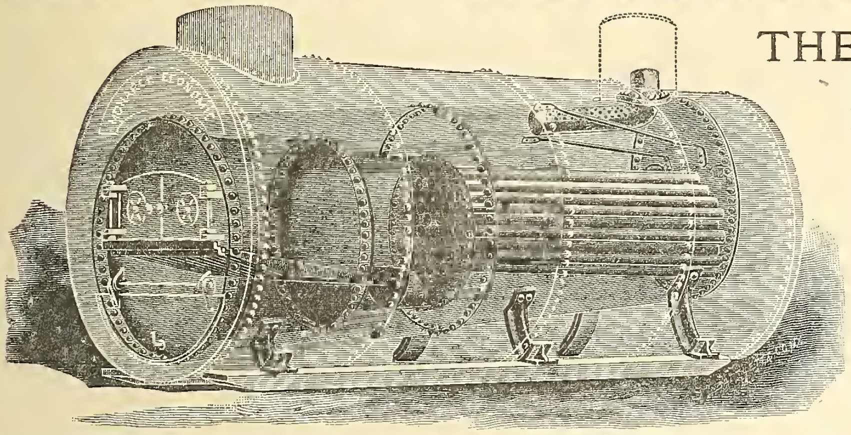

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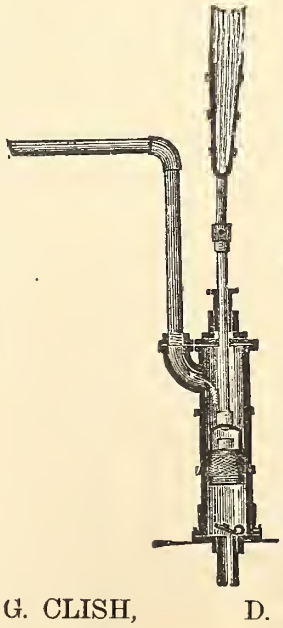

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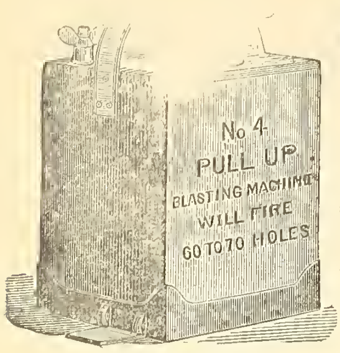

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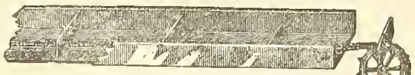

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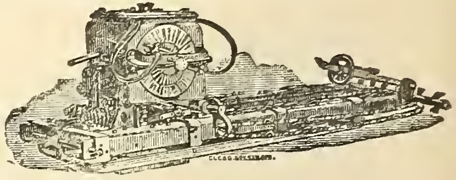

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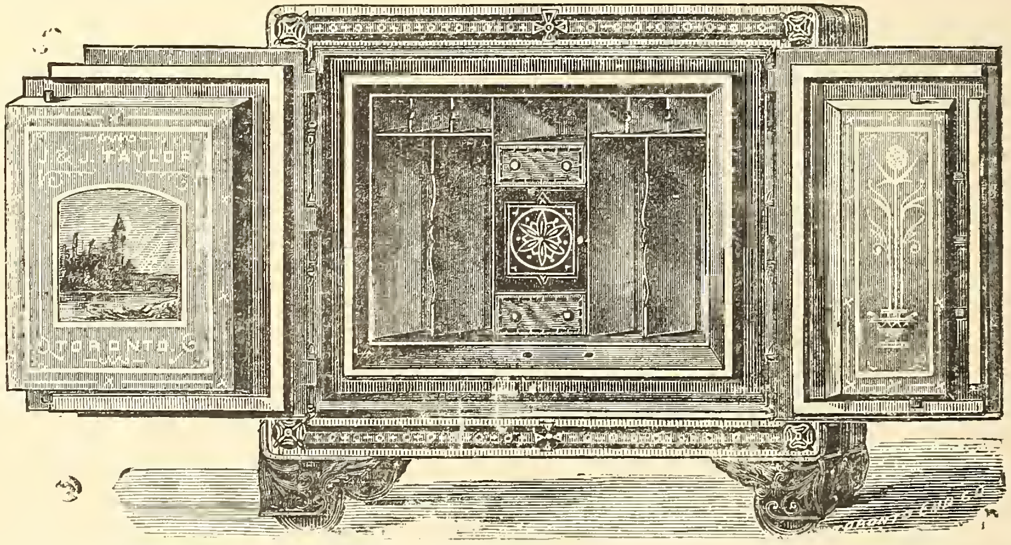

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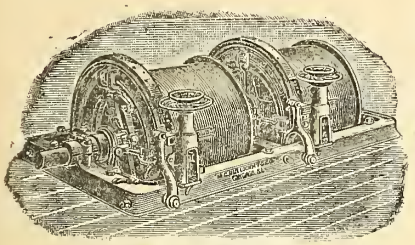

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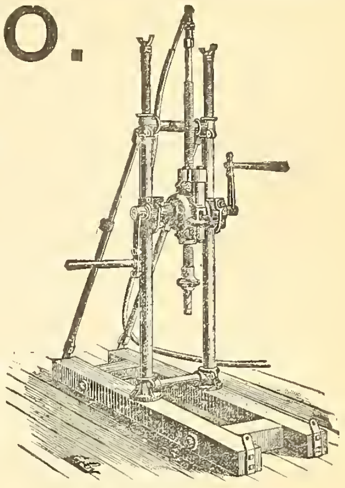

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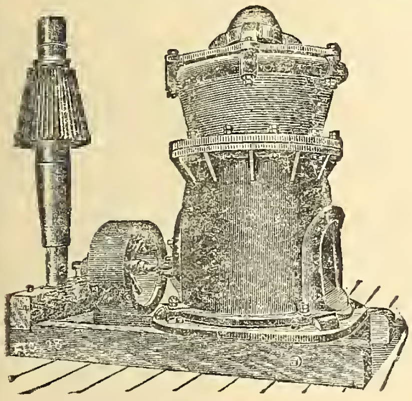

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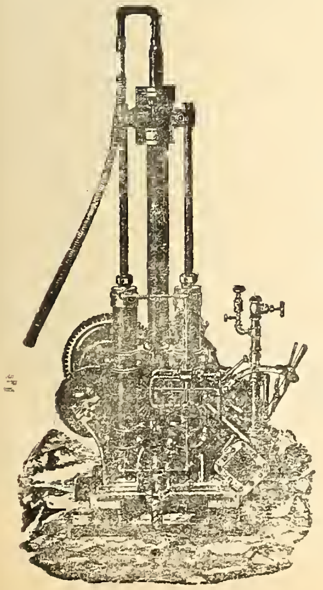

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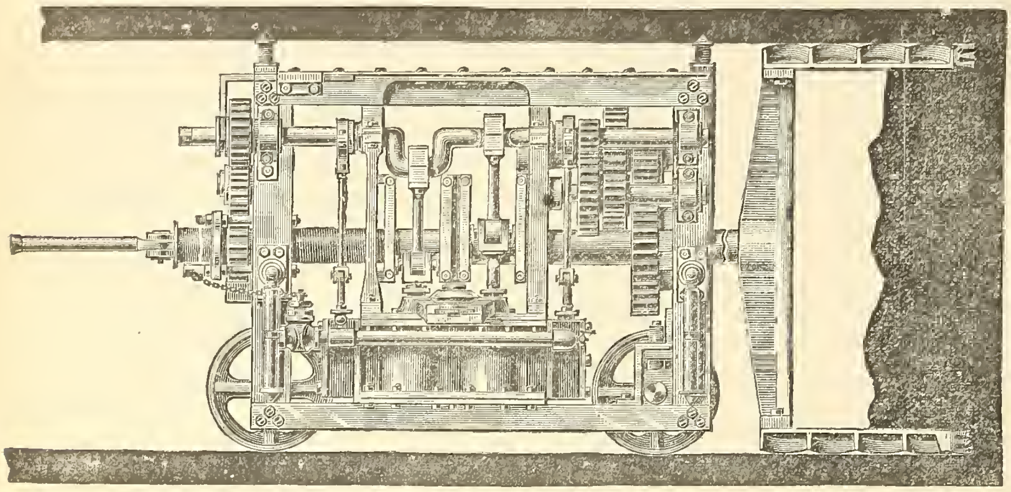

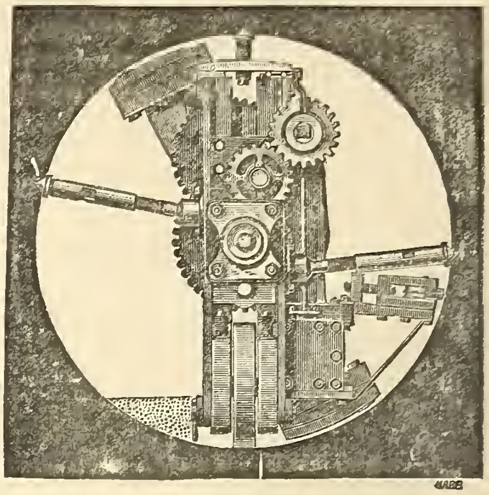

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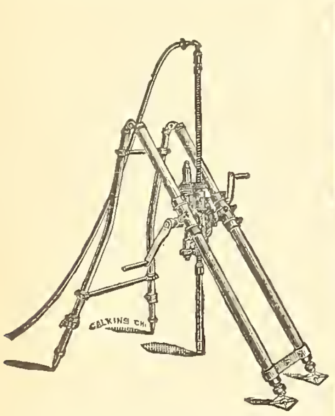

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Capacity—300 ft. depth.

Removes $1\frac{3}{16}$ inches solid core.

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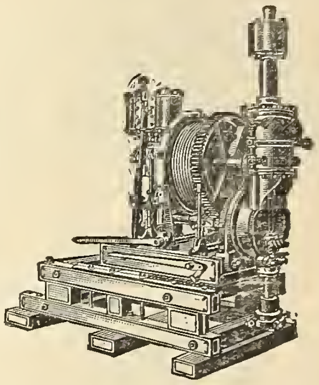

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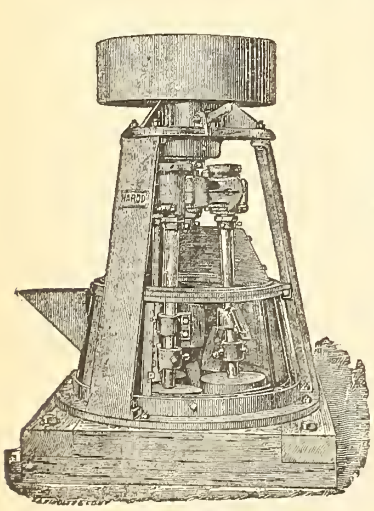

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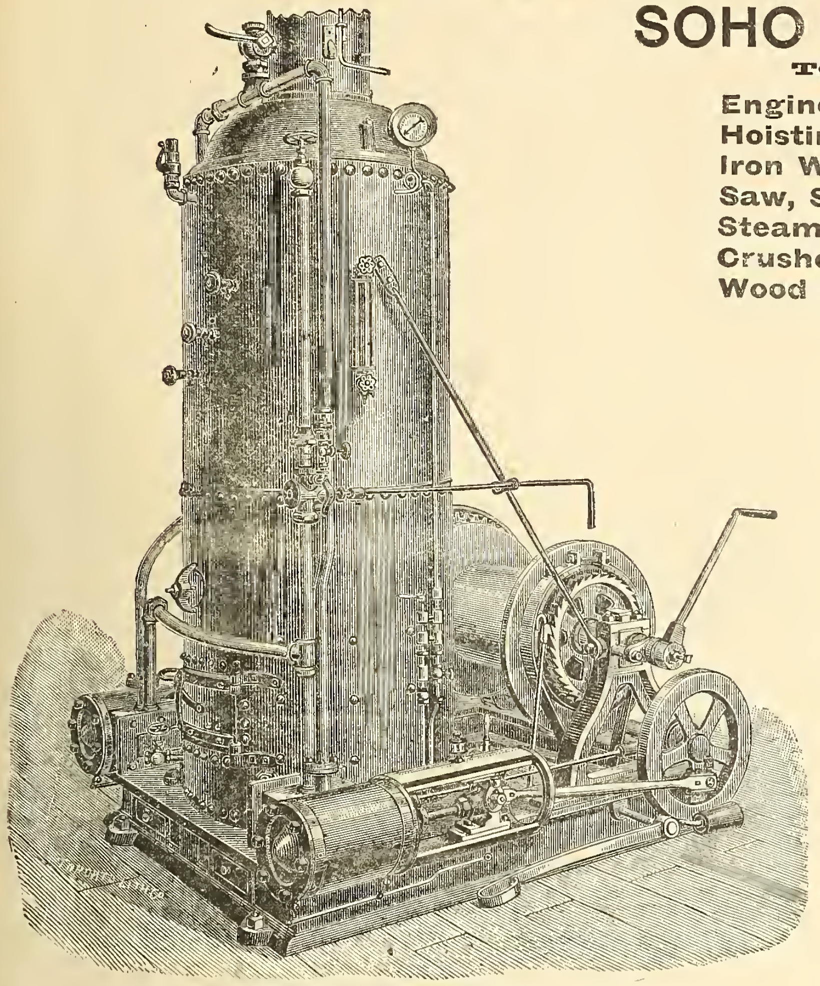

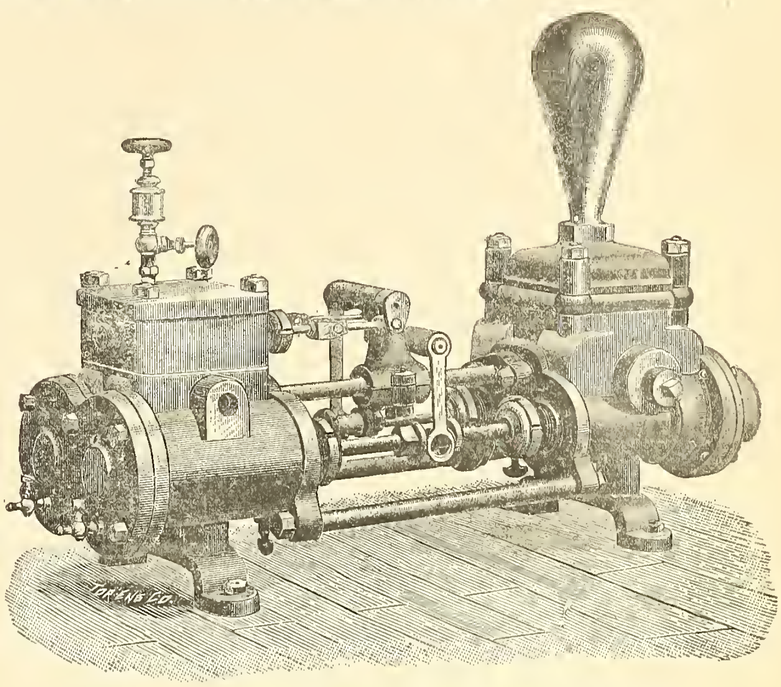

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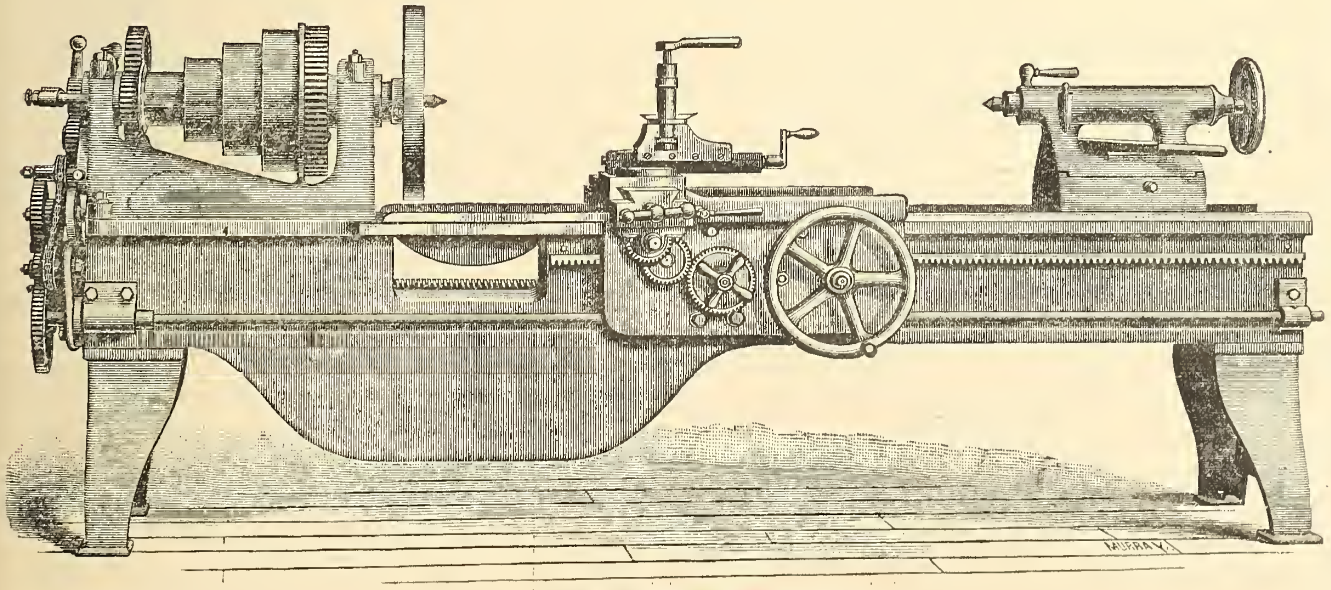

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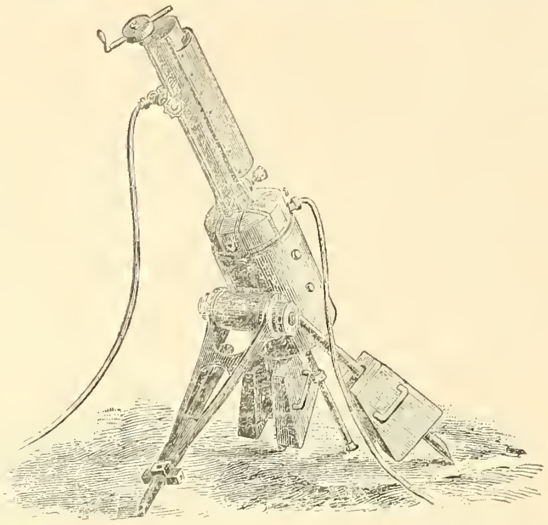

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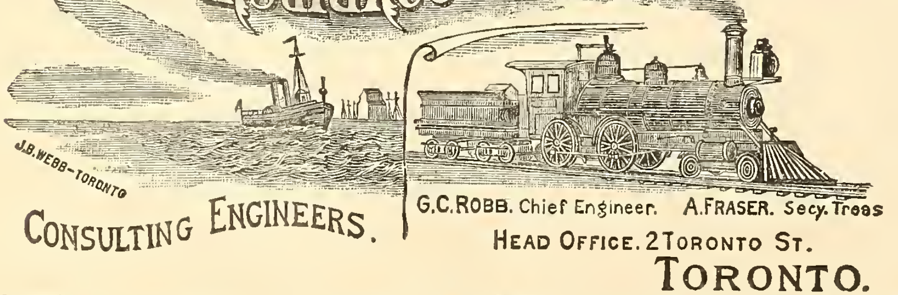

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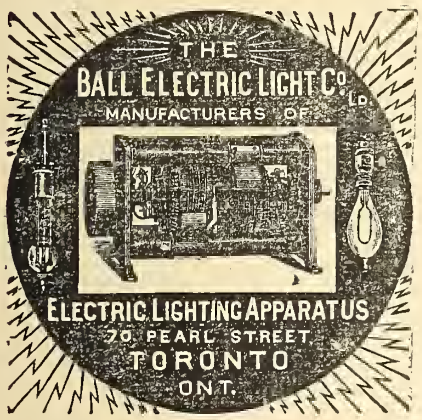

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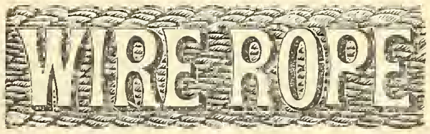

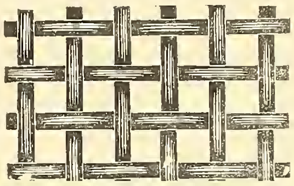

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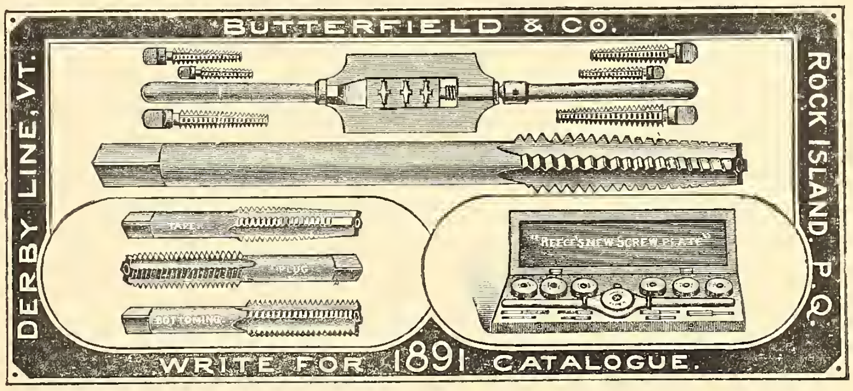
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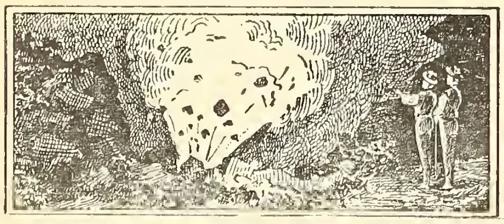

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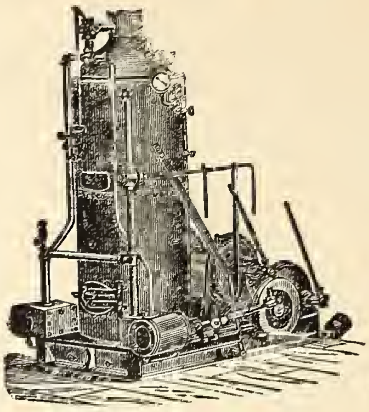

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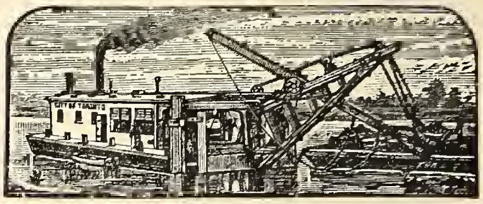

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Iron Ore Production in the United States.

The bulletin on this trade lately issued by the United States Census Bureau, has been compiled by John Birkinbine, C.E., whose well-known reputation for ability is fully maintained by the exhaustive treatment of the subject. The following extracts will give the principal features of this immense industry likely to be of practical interest to readers of the *Review*:

The quantity of iron ore produced in the United States during the year 1889, was 14,518,041 long tons, valued at $33,351,978, an average of $2.30 per ton. The total product reported at the Tenth Census was 7,120,362 long tons, valued at $23,156,957. Of the twenty six states and two territories producing iron ore in 1889 the four leading ones are as follows: Michigan, 5,856,169 tons; Alabama, 1,570,319 tons; Pennsylvania, 1,560,234 tons, and New York, 1,247,557 tons, aggregating 10,234,259 tons, or 70.49 per cent. of the total product. The number of employés engaged in mining iron ore was 37,707, who were paid in wages $13,880,108. The capital invested was $109,766,199, distributed as follows: Land, $78,474,881; buildings, fixtures, etc., $7,673,520; tools, implements, etc., $8,045,545; cash and stock on hand, $15,572,253.

The plants of concentrating works represent a cost of over $500,000. The quantity of iron ore passed through water jigs or magnetic separators in 1889, is stated at 95,425 long tons. The labor cost of ore mined aggregates $24,781,658, equivalent to an average of $1.71 per ton of ore mined, against $2.21 in 1880, a decrease of 50 cents per ton, or 22·62 per cent. The difference includes more than supplies and materials. The figures indicate the advance made in labor saving-appliances and improved facilities for mining and handling the product of the mines. In cost of producing, Alabama is the only State which averages less than $1 per ton, viz., 82 cents. The cost in other States is given as follows: Texas, $1.05; Tennessee, $1.08; Pennsylvania, $1.10; Georgia and North Carolina, $1.14; Connecticut, Maine and Massachusetts, $2.73; New Jersey, $2.74; Michigan, $2.07; New York, $1.64; Minnesota, $1.80.

The production of the several leading countries in 1889 was as follows:

	Long tons.
Great Britain	14,546,105
United States	14,518,041
Germany and Luxemburg	11,001,042
Spain (shipments from)	5,067,144
France	2.500,000
Austria-Hungary	2,300,000
Russia	1,400,000
Sweden	985,904
Algeria	475,000
Cuba	256,278
Belgium	220,000
Italy	178,489
Canada	75,162

The importation into the United States in the same year was 853,573 tons, valued at $1,852,392. Of this quantity 243,255 tons came from the Island of Cuba, 477,654 tons from Europe, including 54,496 tons from England, 97,583 tons from Africa, 14,450 tons from Newfoundland and Labrador, 13,670 tons from British Columbia, from Quebec and Ontario 4,091 tons; and from Turkey in Asia 2,870 tons.

The following is a summary of the furnace yield of various ores in the different producing centres: The returns from Alabama show that a great majority of the ores used were obtained from local mines, although some was brought from Georgia. The average yield in the blast furnaces of the iron ores used was 46 per cent. Over 70 per cent. of these ores was red hematite, the balance brown hematite, with the exception of 2,100 tons of mill cinder. The blast furnace reports show that the ores used ranged from 30·5 per cent. to 51·6 per cent. of iron. The three New England States, Maine, Connecticut and Massachusetts, used local ores entirely, showing an average of 44 per cent. of iron in the brown hematites smelted, the only character of ore at present mined in these States. Most of the ores used in Georgia and North Carolina blast furnaces are local, the approximate proportion being one-third brown hematite and two-thirds red hematite, with a small amount of magnetite and mill cinder, the average yield being 44·7 per cent. of iron. Illinois produced no iron ores and obtained the entire supply of its furnaces from the Lake Superior region. The returns for the entire pig iron production showed a yield of 60 per cent. Ninety-four per cent. of the ore charged was red hematite, 2·5 per cent. magnetite, and 3·5 per cent. mill cinder. The yield of ore in the blast furnaces in Maryland, using nearly all local and Virginia ores, averaged about 41 per cent. of iron, but those consuming foreign ores imported from Cuba and the Mediterranean bring the average for the state up to 47·7 per cent. The location of the majority of the Michigan blast furnaces within convenient distance of the ore supply gave these plants, which use charcoal as fuel, some of the ores of lower grade than could stand transportation to distant points, and hence the yield of ore in these furnaces is lower than would be supposed, viz., 58 per cent. of iron, and lower than the yield of Lake Superior ores in furnaces at greater distances. The red hematites formed the bulk of the supply, but some magnetites and brown hematites were also used. The blast furnaces in New Jersey, while depending chiefly upon the local magnetites of that State, also receive a portion of their supply from the Lake Superior region, from New York, a small amount from Pennsylvania, and some foreign ores, the yield for the State being 51·9 per cent. About one-half of the ores used in New York are local magnetites; over 30 per cent. were red hematite from that State and the Lake Superior region, the balance being made up of brown hematite from New York and the New England States, carbonates from New York, and mill cinder, etc., the average yield being 47·6 per cent. of iron. Ohio obtains the bulk of its ores from the Lake Superior region and from its local carbonates, although some magnetite from New York, carbonate ores from Kentucky, and red hematite from Missouri are used. These ores yielded on an average 56·7 per cent. of iron. Pennsylvania is the largest consumer of foreign ores, fully 85 per cent. being shipped into that State, and several furnaces draw their entire supply from this source, with an occasional admixture of local cinder. It is also the heaviest consumer for the Lake Superior ores, obtaining most of its red hematite from that region, which are supplemented by some local ores. In addition to its supply of magnetite from the Cornwall ore hills, Dillsburg, etc., it obtains this class of ore from New York, New Jersey, and Lake Superior region. The brown hematites are mostly obtained from local mines, although some were sent from Virginia. Some local carbonates and some from Ohio are also used. Instances of dependence upon one class of ore show a yield from hematites obtained from Spain and Africa of 63·6 per cent. and 60·2 per cent.. of all Lake Superior ores 61·5 per cent. to 59·5 per cent.; of all Pennsylvania magnetites 51 per cent. to 48·5 per cent.; of Pennsylvania brown hematite, 41·5 per cent.; of local fossil ores 37·9 per cent.; and of ore from Cuba and Mediterranean ports 56·6 per cent. The average for the State is 55·3 per cent. The brown and red hematites, which form the chief supply for the Tennessee furnaces, come from local mines, with additions from Alabama and Georgia. Some carbonate ore and mill cinder are also used, the yield for the State being 39·6 per cent. Furnaces using only brown hematites showed an average iron contents of 38·8 per cent. Virginia depends principally upon her brown hematite mines, which supplied over 85 per cent. of the ore used in that State, the balance coming from local red hematite mines, magnetites mined in North Carolina, and a small amount of mill cinder. These gave an average yield of 43·4 per cent. of iron. Local brown hematite and magnetite from British Columbia were used in the Washington blast furnaces, the latter yielding 64 per cent. of iron when roasted. West Virginia obtains most of the ore for its furnaces from the Lake Superior district, and, with the exception of some mill cinder, local brown hematite and carbonate ores, and a small amount of magnetite, is entirely dependent upon that section of the country. This raises its percentage close to 60 per cent of iron. Wisconsin's blast furnaces also draw their supply from the Lake Superior district, and with the exception of some mill cinder the red and brown hematites were the only ores used, and gave an average yield of 57·2 per cent. of iron.

In no country has the transportation of iron ore assumed such proportions as in the United States. Most of the Lake Superior ores are shipped from Lake Erie ports to furnaces 60 to 475 miles distant. In reaching Troy, N.Y., these ores cross in transit cars from Lake Champlain, going south into Pennsylvania. Their smelting qualities bring them into use in the Hocking region of Southern Ohio, in New Jersey and Eastern Pennsylvania. For cheaply handling ore, the railroads from the mines to ports on Lakes Superior and Michigan, have terminal erections, consisting of docks with elevated tracks, 35 to 47½ feet high above water level, fitted with pockets into which the ore is dumped. From these pockets it is loaded into vessels by iron chutes. The investment for docks especially built and equipped for shipping iron ore approximated, in 1889, the sum of $4,000.000.

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The Metallurgic Department of Sheffield Technical School.

To Prof. Arnold's laudable ambition of establishing a metallurgic workshop-school that should be an actual copy of the appliances and practical methods of the very best systems of steel manufacture and iron founding, is due the creation of this institution, for which it is claimed that it will "enable a student to perfect himself in the actual art of manufacture, and permit him, with a confidence born of actual experience, to take a prominent position amongst the supervising and controlling staff of a steel manufacturing establishment." If, in the very cradle of steel manufacture, an institution of this kind is necessary, and meets with the approval of the highest technical authority, how much more should the necessity for a still more complete equipment for instruction in metallurgy impress itself on the people of this country who have a wider range of mineral resources awaiting development, and the necessity before them of either educating their youth in metallurgical knowledge of the first order, or of remaining ignorant and inept as a people in these industrial enterprises which withdraws, year after year, millions upon millions for metal manufactures within the scope of native resources, and—more lamentable loss still—withdraw yearly a considerable portion of the industrious youth of the land.

Passing from the description of the engineering shops, physical laboratory and wood-working departments, the following is an outline of the equipment of the Metallurgic department, given with plans in an extra edition of the London *Ironmonger* of 10th ult.: The open-hearth steel-furnace—of 25 cwt. capacity—with a complete gaseous fuel plant, and hydraulic machinery; a 50-ton testing machine; a crucible steel house, with two melting holes, pot house and pot making tools; a flame and ore-annealing furnace for malleable iron castings; an iron foundry equipped with belted cupola, drying stove, and appliances for green sand castings. The Laboratory is equipped with the most modern apparatus for rapid and accurate chemical examination of iron and steel, fuel and refractory materials. Apertures are provided at various parts of the furnace for testing temperature, for aspiring gases for analysis, and for the spectroscopic examination of combustion and oxidation. By means of glycerine vacuum gauges, the pressure and velocity of the gases in any part of the furnace can be ascertained. It is, therefore, possible to obtain a complete diagnosis of the furnace—both thermic, physical and chemical—at any stage of its operation. The hydraulic plant in connection with the furnace consists of a compressor, accumulator, ladle crane, centre crane and ingot breaker. The iron foundry has a cupola for melting half a ton of metal. The gaseous fuel generating plant is fitted for demonstrating the various different characters of useful combustible gases from solid and liquid hydrocarbons.

Amongst the donors to this institution are the Dukes of Norfolk and Devonshire, Sir T. Mappin, the town trustees and Thomas Jessop, for a total of £8,000. Some ancient guilds and trading companies have assumed a yearly liability of £1,750 for five years, and Sir T. Mappin has given £1,000 towards a prize fund. The endowment fund is not fully quoted, but it is altogether likely that the above statement comprises the principal part of the equipment and sustentation fund.

An institution sufficiently comprehensive to take in the whole field of metallurgic operations, designed "to be an actual copy of the appliances and practical *modus operandi* of the best systems of iron and steel manufacture," with the addition of the Bessemer process, and also with a plant for the reduction of gold, silver, copper, nickel and lead ores, and for refining these metals, "such as to enable a student to perfect himself in the act of manufacture and to permit him, with a confidence born of actual experience, to take a prominent position amongst the supervising and controlling staff of a steel manufacturing," or indeed, any metallurgical "establishment," was submitted in outline to the consideration of the Ontario Government last year, in Inspector Slaght's report. Time will conclusively show that no other system for placing the foundation of mining as well as metallurgical enterprise on a sure basis can compare with this. But time is, in this country, the element which costs, although there is an oriental wealth of it everywhere. So many others get ahead. Even Russia, in the midst of her hunger-stricken peasants, is devising well laid plans for great iron manufactures which command the attention of western Europe, and will no doubt draw to her large sums for investment. Illustrations just like this will continue as the years go by until our forests become huckleberry jungles, and our mines the property of foreign enterprises, reaping wealth in fields of industrial activity which we seem unwilling to learn how to occupy—all this will come to pass, unless our governments, Federal and Provincial, will wake up.

The Quebec Petition.

The following letter has been received from the Deputy Minister of Justice respecting the petition to the Dominion Government to disallow Mercier's blundering Mining Bill :

DEPARTMENT OF JUSTICE, CANADA,
OTTAWA, 10th November, 1891.

SIR,—In reply to your letter of the 9th inst. respecting the petition presented by your Association with reference to the Quebec Mining Act, I am to state that no decision has yet been arrived at, but that it will receive attention at an early day.

I have the honour to be,
Sir,
Your obedient servant,
ROBT. SEDGWICK,
D.M.J.

B. T. A. BELL, ESQ.,
Secretary General Mining Association
of the Province of Quebec, Ottawa.

Just as soon as the decision of the Privy Council has been received, a full meeting of the Association will be immediately convened. At the next meeting, which will be the Second Annual General Meeting of the Association, a number of papers will be read, and the accounts, Report of Council, etc., presented. The meeting will be held in the second week in January.

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EN PASSANT.

The fact known to most mowers is noted in *Iron*, that sunlight takes out the temper of a scythe. Edge tools exposed in shop windows are said to be injured in like manner, and the same effect is attributed even to moonlight.

Our series of portrait sketches will be resumed in our next issue, the subject being Prof. B. J. Harrington, formerly a prominent worker on the staff of our Geological Survey, and now a professor in the Faculty of Applied Science at the University of McGill.

Hadfield's manganese steel, after tempering, shows great power of resistance against longitudinal strains, but on breaking its extension increases in an unexpected degree. The quality experimented with contained 1.36 carbon and 13.9 manganese.

Florida's exposition building at the World's Fair will be a full-sized representation of the old Spanish fort at St. Augustine, 150 feet square, walls 20 feet high and 9 feet thick at the base. The structure will be a frame veneered with phosphate rock, and the walls in the court will be covered with pebble phosphate.

For the first half of this year the production of crude petroleum at Baku was 140,478,707 poods, as compared with 126,059,741 poods for the same period last year. The exports by the Caspian this year were as follows :—Crude, 4,957,575 poods ; kerosene, 11,391,103 ; residues, 43,387,532 ; and lubricating, 291,882 ; total, 60,523,086 poods. By railroad they were :—Crude, 206,304 poods ; kerosene, 22,104,575 poods ; residues, 3,854,873 ; lubricating, 2,272,780 ; total, 28,438,622 poods. The total exports were :—Crude petroleum, 5,173,969 poods ; kerosene, 33,995,678 ; residues, 57,227,398 ; and lubricating oil, 2,564,662 poods.

An immense steam shovel is used for digging phosphate on John's Island, near Charleston, S.C. The range of its work before requiring removal is a depth of 10 feet below its track and 45 feet distance on either side. The dipper can swing through two-thirds of a circle, has a capacity of 1¾ cubic yards, and about two dippers full can be handled in a minute. The machine weighs 56 tons.

A "new steel-making process" for getting rid of sulphur and phosphorus prescribes very fine sand and a small quantity of chromic acid crystals, 300 grammes to the metric ton, to be put into the metal before Bessemerizing. When the blow begins, pulverized ammonia carbonate "enclosed in small balls of pure pig" is added. The balls are not put in together, but in rapid succession. The ammonia is said to distribute the carbon of the pig in the bath.

Several meetings of the Explosives Commission appointed by the Nova Scotia Government have been held, but so far the work done has been confined to a desultory conversation and some preliminaary examination of witnesses. A number of experiments has also been made. The Commission is, however, awaiting the completion of a new explosive and will meet in a few weeks, when we hope the evidence will be of such a nature as to be of interest to our readers in these pages.

The faculty for illuminating dry facts by flashing epigrams is possessed by few enquirers in so remarkable a degree as by Dr. R. W. Raymond. He has lately discussed some legal questions with the acumen of a lawyer and the judicial insight of a jurist, and seems to be as fully at home in this field of enquiry as among professional themes. His testimony before the British Mining Royalties Commission, which merits this characterization, has been published at length in the *Colliery Guardian.* As an example of Dr. Raymond's vivacious style, nothing more picturesque than the following extract could be given. He is speaking of the law of the United States as to mining grants and rights, and passes thence to State legislation on the subject of covenants, and he goes at his subject as if he had Maine's "Ancient Law" before him, for Maine tells us that the early conception of Contract was "obviously rudimentary." The first notion was "that persons under contractual engagement are connected together by a strong bond or chain," *nexum*, to which the parties were *nexi.* And so the American engineer carries us to the Homeric days of the Californian Argonauts: "Our Federal system west of the Rocky Mountains grew out of the peculiar circumstances following the conquest of California, and the ultimate purchase of California and Arizona from Mexico, and the discovery of gold and silver in great quantities on the Pacific coast. The country was over-run with a very large or rather a relatively large population, wholly in advance of surveys. It was filled up with active pioneers—adventurers who had not got a theodolite among them, and could not run a line, and who must needs assert and arrange their own rights among themselves, for they had no courts and no government officers, and we had no railroad connection and no telegraph, and could not govern the country. If it had not been for the Anglo-Saxon element in the population there would have been anarchy; but there never was anarchy. You could not bring together in a desert gulch on the Pacific coast one hundred red-shirted miners, no matter whether they were half French and Italian, but there would be American and English enough among them to assert the Anglo-Saxon principle of self-government. They would have a mass meeting the first day they began to dig; they would select a president and a secretary and make a law, and the next morning they would hang somebody for having broken that law, aad then there would be order."

The good nature of the Ottawa *Evening Journal* is sometimes imposed upon by misguided "boomers," who, for purposes of their own, are always eager for an opportunity to palm off upon the public some highly-colored, and often spurious reports. Of such were the sensational stories published in that paper a few years ago, of rich gold finds in the Buckingham district, which created considerable excitement and did no little harm at the time. Just how much truth there is in its latest sensation, "Phosphate Looking Up," being the report of an interview with one Dwyer, may be gathered from the following excerpt of a letter from the head of an English phosphate company controlling large interests in Canada :—

"I know nothing of any rise in phosphate prices. A few small local purchases have been made by dealers who took foreign contracts last year at high prices and could afford to pay a good figure to complete these orders. I had an offer of 1s. 1d. at Hamburg, for 80% from such a party, but the best offer I have had from consumers was 10½d. at Liverpool, and 11d. at London. It is a singular thing that such prices should prevail when 60% phosphate from Carolina and Florida sells at 10d., but the market has been swamped by sales of Florida high grades. Probably deliveries will fall short and markets may rally in consequence during the winter."

A London letter of Oct. 14th, from Mr. G. D. Jennings, Secretary of the Anglo-Canadian Phosphate Co., Ltd., says :—

"The market continues in exactly the same position. No sales of Canadian 80% are reported. Florida 75 to 80%, has sold as low as 9½d., several cargoes at 9⅞s, and is now quoted 10d., while 60% is quoted 10½d. The reason of the anomaly is that 75 to 80% is rushed upon a limited market and unwilling purchasers, while the 60% keeps quite steady in demand and supply. The estimate from Florida is 80,000 to 85,000 tons. Freights there have ruled very high, 18s. to 25s. being very common, and as much as 30s. having been paid. Most of the mines are in a very bad state financially and a complete collapse is talked of, but this of course would only be temporary and would clear the air for the solid concerns to come to the fore. All manurial products are low. Whole bones make £4 7s. 6d. per ton, and bone meal £4 12s. 6d. in bags."

The McDonald oil field, Washington County, Pa., is producing 40,000 bbls. a day. The Matthews well, in less than 90 days, produced 200,000 bbls. To the question, "Will McDonald repay all?" the *American Manufacturer* answers with these figures: The field contains 400 acres; 2,500 bbls. is the production of an acre of 'rich white sand,' but the McDonald field is exceptionally prolific, and may give 3,000 bbls.; in all, 1,200,000 bbls. Taking from this ⅛ for royalty, will leave the well-owners 1,050,000 bbls., worth, at 65 cents, $682,500. Two hundred wells have been put down at an average cost of $6,000 each.

A bar channeler, made by the Ingersoll-Sergeant Drill Company, is successfully operated in the Pennsylvania State quarries. Experience has shown that channeling machines moving in tracks are not suited for such quarries. This machine rests on four legs, is quite portable, capable of varied adjustment, and with the aid of a counterpoise weight attachment can be used on an incline, and the cutting engine fed up and down hill with satisfactory regularity.

A device has been introduced in anthracite mines for registering the ventilating pressure and indicating when the volume of air furnished by the ventilating fan falls below the required amount. To accomplish this result a small tube running from the return air-way at the ventilating machine or in the mine connects with a flexible diaphragm, and any change in the density of the air in the mine at once causes a movement of the diaphragm, which actuates a registering pen and makes a continuous record upon a revolving circular chart. This chart is a simple matter and is conveniently rotated by a clock, and is divided into distinctive spaces for seven days and seven nights. By this simple automatic arrrangement, a continuous record of the condition of the ventilation is kept for one week, at the end of which time a new chart is needed.

When the iron ore concentration works affect the market, the incredulous will lay aside their scepticism, it is to be hoped. The *Iron Trade Review* says that "producers of Bessemer ore that has found a tidewater market these two or three years when ocean freights were high, are somewhat disturbed over the reopening and successful working in New Jersey of abandoned mines. The process is of course patented, but if its operation could be extended to the Lake Superior country there would be no end of valuable property that has heen abandoned for lack of paying results with ordinary methods." It is even so. The magnetic concentration process will come into use everywhere an ore can be found that admits of beneficial treatment under its operation with the necessary conditions for economical success. That is a safe proposition, and there will be "no end" of its application in the Lake Superior region.

Improved docks at Two Harbors and other points on Lake Superior, and the construction of several large steel boats, raise the expectation of important changes in the iron ore trade of Michigan and Wisconsin in 1892. The Cleveland *Marine Review* says the greater bulk of the ore will be carried in what are called "flyers," boats that are unloaded in a single day, and are handled between shipping and receiving ports with clock-like regularity: and that the result will be the construction of still larger vessels for the ore trade. The large iron milling companies are not expected to pay their customary big dividends this year, as well on account of the low prices of ore as from the extension of their operations in acquiring vessel property and terminal facilities.

A luminous spirit-level tube differs from the ordinary tube only in being backed by a phosphorescent compound, which is covered by water-proof lacquer. The instrument will doubtless be appreciated by mechanics working in poorly lighted shops.

The Solvay Process Company, of Syracuse, N.Y., is putting up coke ovens for experiment upon the production of ammonia from coke-oven gases, the company being a large consumer of ammonia in the manufacture of soda from the saline brines at Syracuse.

How a crank pin too small for its place was made to fit by heating, covering with soap to prevent oxidation, and again heating it for some time, but not enough to redden it or raise a scale, is told in the *Saturday Engineer*. At this stage it had swelled enough to make a good driving fit, and was again heated, then put in a lathe and polished. The crank was expanded with the aid of a gasoline blow-pipe, the pin pushed into place, and when crank and pin had cooled down the job was found a complete one.

Two new patent furnace bells and hoppers are announced. The invention of B. F. Conner, Columbia, Pa., is described as an outer or upper bell, which closes the mouth of the hopper and has itself a central opening closed by an inner bell. A counterbalanced beam above the hopper supports the outer bell, while a lever connected with the inner bell is attached to the piston of a steam cylinder, to which an adjustable arm on the piston is fitted to engage the counterbalanced beam. The bells may thus be operated independently of each other. The invention of W. L. Wise, of London, is an ordinary changing cone, the improvement in which appears to consist in varying the periphery so as to attain the uniform distribution of the materials, irrespective of size and density. After the charge is tipped over the cone and in falling is distributed over its periphery, the cone itself makes a revolution and thus the charge is equally sprayed over the surface of the furnace or kiln.

The immense commerce of the upper lakes and the certainty of the great increase awaiting it, attract attention to the prevalent low water phenomenon. It is said that it is lower at the Straits of Mackinac by 3 feet than at any time in 10 years, and lower by 4 feet at Kingston. There is a fall of 326·3 feet between Lakes Ontario and Erie, 8·4 feet between Erie and Huron and Michigan, and 20·4 feet between Huron and Superior. It has been recommended that a sill of very large cut stones should be built up from the bottom of the St. Clair River, where Lake Huron enters it, to within 25 feet of the surface. The river here is 800 feet wide and 60 feet deep. A similar work is said to be necessary where Lake Superior enters the Sault river, and where Lake Erie enters the Niagara river. Another recommendation is to fill up the Niagara River near Tonawanda with large stones. It is claimed and also denied that the deepening of the river channels helps to drain the lakes.

Compressed fuel for use under steam boilers has been an important factor in the development of the coal trade in France. Being less pure and more friable than English coal, the profitable use of fine refuse has always been of great importance in working French coal mines. The industry has grown from a production of 1,000,000 tons in 1820 to 24,000,000 tons in 1889. A factory for compressing coal dust requires steam generators, a crusher of pitch or kettles for melting pitch, a meter for pitch and coal to determine the proportions, machines for mixing and heating, a press to conglomerate, and an endless canvas for moving and cooling the briquettes. At Lognières with an oven 1.50 by 7 metres, costing $1,372.50, the results were: In 10 hours the furnace treated 60 tons of washed coal, containing an average of 6 per cent. humidity, reducing it to 3 per cent. The humidity was still further diminished to 1.8 per cent. by passing the material through two pugging mills. The fuel used was 1.65 per cent. of the weight of the briquettes made. Dry pitch is mixed with the coal when it first comes from the furnace and before entering the pug mill. Compressed fuels made of peat coke, wood charcoal, and even saw dust, concreted with crude petroleum, tar, or glutinous material, such as refuse molasses, have been the subject of various patents probably now out of date. Patent fuel is now sold in South Wales from 6d. to 1s. per ton above the price of the best house coal, and the success of the manufacture is sufficiently evident to warrant experiment in this country with some of the forms of compressed fuel invented for saving the enormous waste of our saw mills.

The Rothschilds have joined the Baku naphtha syndicate, and it is expected the result will be an extraordinary development of the Russian petroleum trade. The naphtha spring recently opened gives a column 28 inches diameter spurting out of an 18 inch pipe to a great height. The daily product is 500,000 poods (9,000 short tons). Naphtha waste has for some time been used as fuel on the Caspian Sea, on the Volga, and in Moscow. The Black Sea merchant steamers are preparing to use liquid fuel, and the vessels plying on the Lower Danube are expected to do so shortly. Efforts are being made to extend the use of the new fuel to manufacturing and household purposes. The abundance of this material is due to the small proportion of illuminating oil in Russian mineral oil, and the great quantity of refuse turned out in the manufacture of an article that must compete with American oil. It is now proposed to refine the refuse called "astatki," for the extraction of a heavy lighting oil safer to use as fuel than crude waste.

The coming explosive for mines is ammonite, if the promise of its good qualities is not overrated. When tamped with clay and coal dust and fired by an electric detonator it gives no flame, either in a cartridge or scattered loose on an anvil; it cannot be fired by heavy weights falling from different heights; and though a cartridge was immersed in ice and water several hours, one piece of it was fired by a detonator and the other, thrown on a coke fire, burned rapidly without explosion. Among 10 explosives fired from a mortar throwing a cylindrical 29 lb. shot with a charge of five grammes, ammonite stood highest in power, gunpowder lowest.

Fuel gases made by certain processes, says the *American Manufacturer*, are better adapted to certain uses than they are to others. They may be roughly divided into three classes—water gas, producer gas, and what, for want of a better term, may be called illuminating gas. Possibly a fourth should be added to these — sprayed petroleum, which is not really a gas. When petroleum is made into a fixed gas it should be included under one of the heads named. Water gas gives a very high degree of efficiency, but is somewhat costly. Producer gas can be made in great quantities at a cheap rate, but cannot be transported to any great distance; while illuminating gas is of a comparatively high cost and can only be used where the industry requires gas in no great quantities and can afford to pay a high price. To typify the uses of each of these gases it might be said that water gas answers admirably for welding purposes, producer gas for large operations—like rolling mills—and illuminating gas for domestic purposes and small manufactories. While there are several fuel gas processes that have great merit, it must, in all fairness, be said that there are a great many whose performance hardly justify the claims made for them. Some of the most absurd and impossible claims are daily made for the gas manufactured by certain processes. Most marvellous stories are told of the number of thousands of cubic feet of gas that have been made by certain processes from a ton of coal or a barrel of oil—statements that are as absurd as to say that two and two make fifty. Sometimes the promoters of these processes are self-deceived; in other cases they are simply dishonest, and show their dishonesty when parties desiring to investigate their processes, with the hope of using them, begin to make close enquiries as to methods of manufacture and analyses.

Interesting experiments were recently made at the Bedford Leigh Collieries, near Manchester, with an improved form of water cartridge, patented by Mr. J. J. Speakman, of Runcorn. Its main features are as follow: The explosive charge, which, in the experiments made, consisted of tonite, is placed in a tin tube of suitable size for an ordinary shot hole. This tube is filled with water and the cartridge partially suspended in the water by means of the wire connection with the detonator, which passes out of the side of the tube at one end. When the charge and water have been placed in the tube it is plugged at the open end and the projecting wire connected with the battery wire; the cartridge is then placed in the shot hole and rammed tight in the ordinary way. The advantage claimed for this cartridge is that there is no flame and no risk of explosion, simplicity in manipulating the apparatus, no loss of time or work as under the old style of naked explosives, and that the coal is not shattered as in ordinary blasting, whilst the cartridge can be supplied at a sufficiently low cost not to interfere with general use. Four ordinary shots were fired in the coal with 4 oz. charges of tonite, and in no case was flame observable, whilst the coal was brought down in excellent condition. As a more severe test two blown-out shots were tried in the hard metal, and no indication of flame was seen, whilst as a final test a loaded cartridge was fired in the open on the mine floor near the pit-eye, and there was again no indication of flame. These experiments may be taken to have definitely proved the absolutely flameless properties of this cartridge. Tonite is a nitrated gun cotton, containing 47·5 per cent. of barium nitrate to 52·5 per cent. of gun cotton. In potentite potassium nitrate takes the place of barium nitrate.

It is reported that an order from the German Government, through its agents in the United States, for 85 tons of pure aluminum, has not been placed and will probably not be for some time. There are only two companies, the Cowles Company, of Lockport, N.Y., and the Pittsburgh Reduction Company, of Pittsburgh, Pa., which could deal with such an order, and neither can accept because of a patent litigation which is now waged between them, and the probability is the German Government will wait some time before they can secure the metal. It will be used for buttons, buckles and for field purposes; also in a certain newly-invented pontoon bridge, its great lightness especially commending it for this purpose. The Willson Aluminum Company has been organized with a capital of $45,000 to manufacture aluminum under the patents of Thos. L. Willson, of Brooklyn, N.Y. The works will be at Spray, Rockingham County, N.C., with a capacity of 400 lbs. per day. The company has had built a dynamo of 1000-horse power and has a large water power at command. Works will be in operation in the early part of next year. The aluminum will, it is said, be produced from corundum and bauxite. The Minet process for aluminum will soon be in operation at St. Michel, Savoy. The motor is a waterfall driving two dynamos of 3,600 amperes and 50 volts each. Six thousand-horse power will be used to begin with, which will be increased to 20,000 horse power. The metal will cost by this process 70c. per kilogramme, exclusive of motive power, which can be estimated on the basis that 1 horse power yields 30 grammes of aluminum. The electrolysis of fused fluorides of sodium, aluminun and chloride of sodium requires for the production of 1 kilogramme of aluminum 1½ kilogrammes of aluminum fluorides, 2 kilogrammes of alumina and 1 kilogramme of sodium chloride.

As a postscript may be added the annouucement that the Pittsburg Reduction Company has coutracted to supply the German Government with a large quautity of aluminum for the manufacture of caps, cartouche boxes and knapsack linings, the object being to diminish the soldier's burden.

The Cleveland *Marine Review* mentioning the improvement in machinery for handling coal and ore on the lakes during the past few years, says that before 1878 coal was unloaded from cars into pockets and reached the vessels through chutes. This crushed the coal so that both shippers and purchasers soon saw some method must be adopted for handling it more carefully. When machinery was first introduced the vessels were mostly canal size, or of about 600 tons capacity, and all single decked. Soon afterward vessels began to increase in size, the capacity reaching 1,500 to 2,000 tons. With this came a change from single to double decks, and the space from upper deck to bottom of the vessel was increased from 10 feet to 20 and 23 feet. The ordinary turn-over bucket which was tripped or turned over above deck was found to have no particular advantage over the chute system, as the distance the coal fell was being increased. Nearly every manufacturer on the lakes has been experimenting on buckets of different descriptions, hoping to get something that would enable them to put the coal into the vessel without dropping it. This was not accomplished until Mr. W. E. Ludlow introduced his bottom dump bucket, which not only places the coal in the vessel without breaking, but so distributes it that little trimming is required. They have now been in use at this and other ports for two years and have given entire satisfaction. Vessel owners are pleased with the bucket for the reason that it does not injure the hatches, and there is less dirt left upon decks and rigging. Mr. Ludlow has been using an automatic trip on one of the machines of the New York and Cleveland Gas Coal Company, so constructed that it can be set to trip the bucket at any distance from the bottom of the vessel that is desired and it will continue to do so until a change in the trip is made. With the trip, three buckets of coal can be put into a vessel as against two where the bucket is tripped by hand.

The progress of late made in mining and metallurgy in Russia, says the London *Mining Journal*, "must in a few years have an appreciable influence upon the industries of the west of Europe. The gold mines of the Oural Mountains, and the ironworks of Ekaterinburg are being exploited in a more systematic manner than ever before; at the same time branches of the industry are being established elsewhere, and the south-west district of Russia is destined before very long to become one of the most important iron producing centres of the Continent. The discovery of the Donetz coal basin opened the way to this growing industry, and allowed of the profitable utilisation of the minerals that are to be found in the neighbourhood. Private enterprise is displaying itself in the opening up of mines with native capital, and the authorities are stimulating the manufacture of iron by placing contracts with native makers that hitherto had gone abroad. The Russian Minister has given out contracts to native makers for the supply of metal sleepers for a period of 40 years; if this experiment is a success it has been determined to use metal sleepers upon all the lines throughout the country." Some of the early State grants for railways were conditioned on the use of rails manufactured in the United States. It is not impossible that Russian statesmen may have got the notion of "stimulating the manufacture of iron" in this way from the American source. It is said that in some Canadian provinces a few years ago, contractors on colonization roads were required to buy picks and shovels from Government supporters, but it is not known that it was required they should be of home manufacture. It would apparently be a useless attempt to trace to a Canadian source any notion of "stimulating the manufacture of iron by placing contracts with native makers."

A crack in the inner tube, near the muzzle of the 110-ton gun on H.M.S. Victoria, the "slight splint," reported on the inner tube of the 67-ton gun on the Howe, a similar defect in a big gun on the Anson, and the removal of the big guns of the Benbow for operations to strengthen them, are quite recent proofs of what the London *Post* calls "constant gun failures." A correspondent of the *Ironmonger* says that steel is liable to be changed by the action of time apart from external mechanical or chemical influences. Of course this view will not be accepted by metallurgists, except in so far that time may be necessary for the development of the stress which results in rupture. The correspondent referred to says that at an engineering works in London several steel plates cracked spontaneously, with loud reports, some months after they had been received and before any work had been done to them. Another instance is the cracking of hardened steel shells several months after delivery to the authorities. This is attributed to the after effects of the hardening process, but he asks, Why did they not crack during the operation? Dr. Anderson, in a paper on "Tests for Steel Used in the Manufacture of Artillery," read at the May meeting of the British Iron and Steel Institute, says that the unequal tension of the metal caused by oil-hardening, or in some other manner, produces rupture, the exciting cause being a slight change of temperature, or "some other relatively slight cause." It is well known that some cutlery firms prefer to keep their cast steel ingots two or three years before working them, because experience has shown that the steel is thereby improved.

The following new alloys are announced: Nickel-aluminum—20 parts nickel, 8 parts aluminum—used for decorative threads; zinc-nickel pigment—90 parts zinc, 10 parts nickel; nickel hard lead type-metal—100 parts ordinary type-metal, 5 parts nickel; platinide, for crucibles and chemical utensils—60 parts platinum, 35 parts nickel, 2 parts gold, 3 parts iron; roseine, for jeweller's work—40 parts nickel, 10 parts silver, 30 parts aluminum, 20 parts tin; sun bronze—60 or 40 parts cobalt, 10 parts aluminum, 40 or 30 parts copper; metalline—35 parts cobalt, 25 parts aluminum, 10 parts iron, 40 parts copper.

A new metric system by Mr. Hanssen, a Danish engineer, detailed in the *Chemical News*, is simple and has many of the merits of the French system with few of its objectionable features. Nobody seems before to have noticed the approach to interchangeability between our principal units of weights and measures. Mr. Hanssen proposes to increase the inch and foot to 1·000403 times their length, or about $\frac{1}{2500}$, less than $\frac{1}{200}$ of an inch to the foot, and the ounce, pound, and imperial gallon will need no change. A cubic foot contains 436,971·78 grains of distilled water; the new cubic foot would contain 437,500 grains, or just 1,000 ounces avoirdupois. Sixteen cubic feet would equal imperial 100 gallons, or one hektogallon, which will weigh 1,000 pounds. The foot will be divided, like the meter, into decifoot, centifoot, millifoot; there will be hektogallon, dekagallon, gallon, decigallon, centigallon, milligallon and so on with others. Of course governments must first agree on the basis; but it could quickly be made what the French metric system may never become—a really popular utility, displacing old standards.

"The spontaneous ignition of coal," was the subject of a paper by Prof. Vivian B. Lewis, read at the Cardiff meeting of the British Science Association. The heat from the spontaneous ignition of pyrites, to which Berzelius ascribed the ignition of coal, would not if localized be sufficient to raise the temperature of the adjacent coal to ignition. The cause must be found, in Prof. Lewis' opinion, in the power of finely divided coal to absorb oxygen which causes the slow combustion of some of the hydrocarbon constituents at the ordinary temperature. The risk is greatest with large masses of coal and the ordinary air supply on board ship. Oxidation increases rapidly with the initial temperature, hence coal fires occur most frequently on ships while in tropical climates. It may be roughly estimated that the absorbing power of coal for oxygen is proportional to its power of taking up moisture.

The H. C. Frick Coal & Coke Company of Pittsburg, has completed arrangements for the illumination of its mines by electricity. The contract for the work has been awarded to the Westinghouse Electric and Manufacturing Company. The first two mines to be lighted were Leisenring No. 1 and Leisenring No. 2. The mines of the company are situated in Westmoreland and Cambria counties, Pa., and a number are shaft mines, varying in depth from one hundred to nearly one thousand feet. Owing to fire damp and gas in many of these mines the lighting has been a grave problem, because almost every known method of illumination included danger from fire. This led to electric lighting. The Frick Company has adopted the method of lighting each mine independently, and at every mine is installed Westinghouse direct current apparatus of sufficient capacity to light up the mine below, and the buildings above ground. The lamps are distributed underground throughout the main walks leading to the shaft. The engine house and other surface buildings are also lighted. The lamps range from 16 to 50 candle power. Electric light plants are now being put up at Leisenring No. 3, Trotter and Standard mine, but it will probably be a year before the plants for all the mines are installed.

The following is the story, according to a New York *Sun* reporter, told by an old man on whose land natural gas was first struck in the Findlay, Ohio, district:

"Wall, you know," he began, "my son Bill was a great hand to read. One day he had laid away a book he had been reading and says to me—'Dad, I've been reading up on minerals, and I am going to find somethin' right here on our farm.' 'Shoo, Bill,' says I, 'but you wouldn't strike nothing outside of the cobble-stones and worms.' But he must at it, and began to dig, and bore, and fool around, and leave me to hoe the corn, and one day he struck su'thin'. There came sich an infernal smell that both of us was drove to the house, and then the smell got so bad that we was drove to a neighbor's, and we had to let the hogs out of the pens or they would have keeled over. 'Bill,' I says, when I got where I could breathe again, 'you said you'd strike sunthin', and you have. You've wasted three month's time gettin' down to where Christopher Columbus buried about a thousand tom cats, and we've all been driv off the farm in consekence. It's my turn now to strike sunthin, and you get ready for the all firedest lickin' a boy ever got. I give it to him, gentlemen, and then I went spooking around to find somebody who'd buy the farm at about the cost of the barn. A fellow who seemed to have catarrh, and didn't mind the smell, closed up a deal with me and I had to grin as I walked off with his money under my arm. I kep on grinnin' for about a week, but then I heard some news that stopped me, and I guess it's three years since I've opened my mouth sideways. Them dead cats was worth $100,000 to me, and I sold em for $800, and walked around pattin' myself on the back for being' so all fired cute."

It often happens that in starting work on a mine with a small stamp mill, the yield per ton of ore is for a time satisfactory and up to calculations, because the mill can be supplied with ore from the best portions of the vein; but on adding a large mill the conditions are all changed. The mine must be then worked regularly and systematically, and the large consumption of rock by the mill makes it impossible to pick out the ground as before, consequently the yield per ton runs down at once. This simple explanation of lower yield is often kept out of sight by specious assertions as to large loss in tailings. The following experience in some African mills, related by McDermott and Duffield, in their excellent little work, "Gold Amalgamation and Concentration," will serve to illustrate this fact by figures that can be understood by the most inexperienced: "The Robinson mine for several months produced in the neighbourhood of 4,000 oz. of gold with 10 stamps. When 30 more stamps were added, the yield of gold was 8,000 oz. from more than four times the quantity of ore formerly producing 4,000 oz. In other words, the grade of the ore dropped 50 per cent., when the crushing capacity was increased four-fold. The Jumpers mine, in its first workings, in 28,000 tons of ore gave an average yield of 20 dwts. gold per ton. In six months' work with 30 stamps, the yield was 18½ dwts. The result of the first month's run with 70 stamps gave 11¾ dwts. per ton; and the second month's run with 70 stamps, 10¾ dwts. In these two cases, the management being good, no question of increased loss in tailings has arisen, but in many smaller mines such explanation would be jumped at by directors, and inventors of new processes would be listened to respectfully."

The use of machines for preparing moulds for the iron-founder is extending among the Staffordshire and Warwickshire manufacturers, says the Glasgow *Engineer*. A new works on this principle has just been erected at Willenhall, and it is expected that with modern improved cupolas a heavy weight of goods will be turned out.

Shipments of Florida phosphate 75/80% from Fernandina are reported by our correspondent as follows:

October 16, Br. Str. Samara to Stettin..	2,210 tons.
“ 24, “ Alceste to London.	1,100 “
“ 28, Br. Bktine Severn “	687 “
Total........................	3,997 tons.
Previously reported....................	31,465 “
Grand total 1st 10 months 1891..	35,462 tons.

Steam traction engines have been built to haul iron ore 100 miles across the Mojave desert from the mines near Haslett, San Bernardino County, Cal. Each engine hauls two trail waggons. The boilers are 20 horse power. Auxiliary engines are placed in the trail waggons and connected with the forward boilers by steam pipes. It is expected each set of waggons will make a trip every two days, hauling 20 tons of ore.

The French Government has ordered that 63 abandoned mines in France are to be conceded to any persons willing to operate them under certain conditions. Of these 21 are iron ore mines, 9 are coal, 11 lignite, and the remainder copper, lead and zinc mines. The State owns the mineral right generally throughout France, and mining concessions cease when the lessees fail to work the properties. It is believed that co-operative associations of miners will be formed to work some of these abandoned undertakings.

When the Countess of Aberdeen was in Ottawa last she was greatly pleased with the beauty and variety of the collection of gems and precious stones cut from Canadian material in the lapidary establishment of C. P. Willimott & Co., and before she left she ordered a handsome necklace of Quartz-Asteria and a smaller one of Amazon-stones. Those of our readers who are ignorant of the resources of the Dominion in gem material should read Mr. C. W. Willimott's excellent review of the subject in a paper just printed by the Ottawa Field Naturalist Club. Mr. Willimott points out that the idea that our crude material may be sold by the ton or hundred-weight instead of by the carat, as Oriental or European gems are, is entirely erroneous; for while some of our semi-gems, such as Agate, Jasper, Amazon-stones, etc., might be so obtained owing to the abundance of material, many of our stones possess a high value and are sold by the carat on account of their scarcity.

The cost of electric as compared with steam power is most favorable for the former in the case of some wharf cranes on a London dock. A 10-ton and a 2-ton steam crane required for their operation $1,250 worth of coal per year, steam being required night and day. The cranes were fitted with electric gear at a cost of $1,500. A gas-engine drives the dynamo, cranes, a chaff-cutter, a corn-crusher and a common friction-hoist, at an expense of $280 for the year.

CORRESPONDENCE.

The New Eldorado.

SIR,—If the average Canadian were asked what he knows about Leadville, he would be able, at least, to say that it is a well known mining camp in the United States; but ask him where and what is Kootenai, and there is not one chance in ten that he will know that it is a new mining field in British Columbia, often now referred to by Americans as a second Leadville. Frequent references in the Canadian press, however, during the last few months, have drawn more or less attention to this great and promising mining region, and now the question is being asked: "What about the Kootenai?"

British Columbia has long been known as an immense and promising mineral country, but its chief mineral production, so far, has been gold. Discoveries of the last three or four years have brought into prominence another precious metal—silver. The field of these important new discoveries is "The Kootenai."

Kootenay Lake is a body of water situated in the southern part of British Columbia, a few miles north of the State of Idaho. The lake is an expansion of the Kootenai River, which river takes its rise in British Columbia, near the source of the better-known Columbia River, thence flows southward into northern Montana and Idaho, then back into British Columbia and into the said lake. The outlet of the lake is an arm about forty miles long, through which the waters of the lake empty into the Columbia River. Thus it is that the waters of the two rivers have their course but a dozen miles apart, flow several hundred miles, one south and the other north, and then join each other, for better or for worse, in a long, long flow to the Pacific ocean.

Should one visit the Geological Museum at Ottawa, he might be shown specimens of ore from this region, brought in by our own Dr. Dawson. They are mostly in the form of silver and lead, or rather silver in lead, and called by miners "galena." A little enquiry would elicit the fact that Dr. Dawson was thoroughly acquainted with the locality which produces these ores, and that he has given us a very exhaustive report of his investigations, which has been published by the Geological Survey, and which, as was to have been expected, is as readable as it is reliable and instructive.

Two years only have elapsed since the visit of Dr. Dawson to this region, and yet it has changed from a mere "prospecting" ground known only to a few adventurous miners, mostly Americans, to an actual mining field, beginning to attract so much attention that a recent telegram to a United States newspaper referred to it as the "New Eldorado," with a prediction that the "coming spring would see one of the greatest stampedes since early Leadville days."

It is only a just tribute to the ability of Dr. Dawson, to assert that great as have been the changes brought about, and remarkable as have been late discoveries, they have been no greater or remarkable than a careful intelligent reading of Dawson's reports might have lead one to expect. Since the writing of those reports, mining men, by discovery and purchase, have acquired mining properties which as "prospects" are worth hundreds of thousands of dollars, and which as developed mines undoubtedly will yield many millions within a few years. In this short time railroads have pushed in, steam boats built, saw mills erected, live towns have sprung up, many "prospects" been developed into mines, and within the month of present writing the building of a large smelter and refining works (for the treatment of ores on the spot) has been begun! In a word, the theoretical and prospecting stage has given place to the realization of actualities.

In 1889 there were two mining "camps" only—known as "Nelson" and "Hot Springs." Last year was discovered "Trail Creek;" and the excitement due to the late discovery of two new promising camps has hardly subsided yet.

The best known and most developed camps are those of Nelson and Hot Springs. Nelson is distinguished by having the already famous "Silver King" mine, a mine characterized by the immense size of its ore deposit, and the ore high grade withal. Near Nelson, also, there are some very promising gold properties, quartz, one of which has been fairly well developed already.

Hot Springs is noted, not for any one big showing, but for the extraordinary character of its surface showings as a whole, and for its many well defined leads, or veins of ore, much of it high grade—often in fact running into the thousands. A Colorado mining man who recently visited the field stated to a reporter of a United States paper that "the surface showings were the most marvellous he had ever set eyes on." This was the impression of a man who is principal owner of a mine which has paid a dividend of $600,000 the last year, (J. H. Bolles, of the "Mollie Gibson," Aspen, Colorado).

This verdict is really but a repetition of that given by a score of prominent mining men and experts during the past few years.

A mining expert from Australia, who visited the camp in 1890, stated that "without exception it was the most promising camp he had ever seen as to surface showings." Indeed the general reiteration of this opinion by new comers has become agreeably monotonous in the camp. There are several distinct veins which can be traced for from two to four miles. Their width is from two to four, eight and even twelve feet.

It was almost inconceivable that so great and exceptional a surface showing should be merely surface veins. The presumption of depth in such a case was infinitely more reasonable than if there had been only a few isolated croppings. The more reasonable presumption was that the whole mountain was, to use the words of Dr. Campbell, "perfectly saturated with mineral." Dr. Campbell has since shown his faith by his works, and has his reward in the successful development of several of the most valuable properties in camp, (the "No. 1" and "United," etc.)

But in the advanced mining of to-day, it is only the ore "in sight" that is counted upon, however promising the indications may be, and so it was that the ultimate value of these veins and the future of the camp were considered dependent upon the question of the *depth* of ore veins, which could be determined only by actual development—by digging. Thus the development of the prospective mines becomes a matter of importance to the miners of Kootenai, second only to original discovery.

Some little development work had been done up to the close of last year, but it was only during the past season that enough had been accomplished to satisfy conservative miners of the character of the deposits below the surface. Various claims have been exploited now to a depth of from fifty, one hundred, and two hundred feet and upwards. The latest reported development work was that of the "Skyline," at 200 feet. This being one of the most important mines of the camp, its working was looked upon somewhat as a test case, and the result was awaited with an anxiety almost feverish.

What the general result has been is best expressed by the fact of the building of the smelter referred to.

The vein of the Skyline not only was found, but it was well defined, and *twelve feet* of rich ore.

Indeed it is somewhat remarkable that there has been no disappointment so far in the showings of the claims after development.

In view of the fact that this wonderful wealth, which is now practically in sight, was forecast by Dr. Dawson's report, available to every Canadian, are we not to suppose that it was taken advantage of, and that hundreds of Canadians in different provinces, have taken a hand in this profitable mine development and are to be the medium through which the immense wealth stored in our mountains will reach and benefit our Canadian interests and enterprises? Unfortunately, no.

To one reader of Dr. Dawson's report who by it has been led to put in a dollar of capital, or a day's work, a hundred practical everyday miners who never read, and probably never heard of, any official report, have gone into the field in the last two or three years, and are now reveling in brightest prospects of wealth. And doubtless, nine out of ten of these are, not Canadians, but Americans. American prospectors and capitalists opened up the district, and the region and its wealth are better known and believed in to-day in centres south of the "line" than in British Columbia itself!

The visits of many prominent Canadians during the present season, and their almost uniformly enthusiastic reports, however, may have the effect to change all this as to future operations.

And it were well it should; for if, indeed, these mountains be full of golden treasure that is on the eve of being dug therefrom, it means great wealth, not only to individuals but to the little world about them. Whether that wealth stays in Canada, where nature produced it, or goes to the neighboring Republic, already highly favored by its own natural resources, depends upon the nationality of the men who discover or buy, or mine the rich deposits, for where men make their home, there they are most likely to expend their money.

W. H. LYNCH.

SPOKANE, Wash., 17th Nov. 1891.

The Minerals Under Railway Lines.

SIR,—During recent years, or since the construction of railway lines in mineral sections of the country, in many instances the railway right of way or road bed, has been located or constructed over or through lots of land on which minerals were known to exist. The land expropriated by railway companies is generally a strip of land sixty-six feet wide, measured parallel with the line of railway. The question of the ownership of the minerals underneath the railway right of way has been the cause of costly law proceedings on the part of the owners of mines, both before and after construction of the line of railway.

One memorable instance of injustice to the rights of mine owners, was the case of Messrs. Chambers and Jenkins, owners of an iron mine on lots 17 and 18, in the 8th Concession of the Township of Wollaston, the said lots being next to lots 15 and 16 in the same concession and township, which are better known as the Coe Hill iron mine. The owners of the Coe Hill iron mine are the same parties or part owners of the Central Ontario Railway. The Central Ontario Railway was located and under construction to the Coe Hill mine, and to acquire the adjoining iron mine on lots 17 and 18, the railway company, under their powers to expropriate private property, located a "station ground" of nine and nine-tenth acres in extent, exactly on the site or outcrop of this desirable iron mine, and made offer to the owners of $150 for the land and minerals so expropriated! Legal proceedings, however, prevented such a fraud being transacted under the pretended use of a "station ground," and the deposit of ore is now known as the "Station Mine!" A patent manner this of converting an iron mine into a condition closely related to "steal" by means rendered legal under an imperfect Railway Act. Other instances have occurred as to the ownership of minerals under the lines of railway companies.

The last instance which has come to our knowledge is that at the Murray mine, owned by Messrs. H. H. Vivian & Co., (Limited), near Sudbury, Ont. The main line of the Canadian Pacific Railway intersects the outcrop of ore while passing over this lot in an east and west direction. One of the mining company's shafts is located north of the line of railway, and another to the south of the track. The mine owners desire to connect the workings from these two shafts so as to admit of better ventilation by driving a heading or level under the right of way of the C. P. R., but to this the railway company objects. This is a case for the intervention of an Ontario Inspector of Mines on behalf of mining interests. It also calls for an amendment to the Railway Act of Canada to the effect that railway right of way locations are only a surface right and do not grant the locking up of minerals located several hundred feet under ground to a line of railway. The right granted by a railway charter to a company of crossing the surface of mining lands should not entitle them to hinder or prevent the mineral development of the country, nor ought it to aid them to acquire the ownership of minerals on account of the land being used for railway purposes. There need be no danger to the road bed or to the railway property by conducting underground mining operations when the same are conducted with care and under proper inspection as to the public safety. Mine buildings and whole towns are located over mines and there is no danger when the operations are properly conducted, and why more a line of railway than buildings or towns? We respectfully bring this matter to the notice of the Minister of Railways and Canals, and should he fail to take action, to the Attorney-Generals of the several provinces, to have them take action to protect the rights of miners to work the minerals located under railway lines.

"ENGINEER."

TORONTO, 15th Nov., 1891.

Electric Rock Drills.

SIR,—In view of the interest shown in the Electric Rock Drill, I send you enclosed some correspondence which will be interesting to your readers, and which explains itself. Mr. L. C. Trent is the western manager of Fraser & Chalmers, who represent the Rand Drill Company in his district.

I am, etc.,
MECHANICAL ENGINEER.

NEW YORK, 15th November, 1891.

"Electric Drilling in the Last Chance Mine."

(From the published advertisement of the Electric Drill.)

"The illustration on this page affords a good idea of the ease with which electricity is introduced into mines.

"It shows one of the Edison Drills at work in the Last Chance mine at Wardner, Idaho. Speaking of the operation of the plant, which supplants a pneumatic outfit, the engineer in charge of the mine says: 'Operating two air drills for 24 hours required five cords of wood, while for running four electric percussion drills for the same length of time, each drill doing more work than the air drills, it requires only one and one half cords of wood. The electric percussion drills have been found to do more work than the air drills, and in consequence the air drills have been replaced by electric drills. The air plant was situated 1,000 feet higher up the mountain than was required with the electric drills and the fuel had to be carried to the air plant this increased distance over that necessary for the electric percussion drill.'

"Testimony of this kind is hard to gainsay, and it is more than substantiated by the reports from other electric mining plants."

SALT LAKE CITY,
July 22nd, 1891.

Electrical Engineer,
150 Broadway, N. Y.:

GENTLEMEN,—We note in your issue of July 15th, on page 71, a short article entitled, "Electric Drilling in the Last Chance Mine."

We should be glad to know if this is simply an advertisement, or supposed to be authentic information. It is so grossly at variance with the facts, on which the writer is posted—having lately visited this mine and another where the electric drills have been tried—that we want to protest against it. There has always been so much falsification, exaggeration and misrepresentation in connection with the electrical business that reputable concerns ought to endeavor to stop this. The cause of electrical engineering and manufacturing can never be permanently benefited by such methods. On the contrary, the ultimate result will only be an entire lack of confidence in anything pertaining to electricity on the part of the public generally. We will add that the only reliable method of ascertaining the actual consumption of power in operating these drills has been very carefully suppressed in both of the above instances, as no ampere meter was used, and the writer was informed in the case of the two mines, that the 50,000 Watt generator furnished in each instance was only calculated to run six or seven drills.

Yours truly,
(Signed), L. C. TRENT.

Chas. Sweeny, Esq.,
Wardner, Idaho:

DEAR SIR,—In case that it may not have come to your notice, the writer encloses herewith a small article taken from the *Electrical Engineer* of July 15th, as a sample of the methods used by some concerns in advertising their business, for you will be better able than anybody else to determine how far the statements contained therein are correct.

Yours truly,
(Signed), L. C. TRENT.

WARDNER, IDAHO,
August 2nd, 1891.

L. C. Trent, Esq.,
Salt Lake, Utah:

DEAR SIR,—Your favor calling attention to article in *Mining and Engineering Journal* at hand. In reply, have to say that said article is wholly untrue. Up to date the electrical drills are not a success. We have discontinued their use. The plant is still here and the Edison Co. are experimenting with it. The great trouble seems to be the heating of the drill, demagnetizing, and consequent loss of power. When the drill heats it is perfectly useless. If they can devise some scheme to overcome that trouble, I think it will succeed. They had great mechanical difficulty to start with, but have remedied that pretty well. You will see no certificates signed or authorized by this company unless that company make some very material improvement over present condition.

Yours very truly,
(Signed), CHAS. SWEENY, Manager,
Last Chance Mining Co.

LEGAL.

Hon. George Irvine, Q.C., v. J. J. Williams et al.

Judgment by Mr. Justice Wurtele in the Superior Court, Montreal. This was an action to recover royalty on an asbestos mine. The plaintiff represented that by notarial deed at Montreal, March 26th, 1888, A. H. Murphy sold to defendants the undivided two-fifths of lot 32, range B, Township of Coleraine, of which he was the owner of four-fifths, and J. T. Wilson and W. S. Patterson of the other fifth; that it was a condition of the sale that the defendants had to open and work the asbestos mines upon the property in an efficient manner during the term of three years from December 31, 1887, and pay the vendor a royalty of $9 per ton of asbestos mined and shipped from the property, and that (except the first year) they were to mine at least 400 tons a year. The plaintiff, under assignment from Murphy claimed $5,040 royalty and interest. The defence was that Murphy had waived his right before the assignment, and was not entitled to any royalty at the time. There was also a claim of damages set up in compensation. The court held that the plaintiff was entitled to $2,520 royalty, and over-ruled the claim offered in compensation. The demand for royalty for 1890 was held to be premature.

Mining in the Yukon Country.

About 40 miners have returned from this season's work in the North Yukon districts. About 120 men will spend the winter on Forty-mile Creek, while about 40 others will winter at other points along the river. Among those who have returned is Wm. H. McPhee, who has spent four consecutive seasons in search of the yellow metal in the "frozen North," and during that time has gained a very good general knowledge of the country, and especially in the vicinity of Forty-mile Creek, where most of the mining has been done. He says that until the past season the principal mining was done on the bars, which were not yielding very good returns on account of the facilities for working and the limited time that they could be worked, so prospecting in the gulches was commenced quite extensively, and resulted in finding excellent prospects in Franklin and Nugget gulches, and quite a number of claims were located and work commenced. In one of those gulches a $100 nugget was found, which created considerable excitement, and a few days after a nugget worth $236 was picked up by Lawson and Dale, which augmented the excitement to a fever heat, and a general rush was made from the surrounding claims to the gulches, and every foot of ground was located in short order and work commenced in a business way, and in a short time everything resumed a normal condition. The finding of these two nuggets and a number of smaller ones, ranging from $10 to $50, caused great excitement. The miners say there are thousands of miles along the Yukon and its tributaries where diggings can be found that will pay from $4 to $10 a day, if only decent trails can be opened up.

New Brick Machine.—A very powerful dry press brick machine has been invented in the United States. The great power of the machine is due to the employment of four compound levers of the first order. The dry clay is first fed into a disintegrator, in which it is reduced to powder, and in this condition is elevated to a platform over the press, where it passes through a sieve to the hopper of the machine, the coarser portions of the clay being automatically returned to the disintegrator. From the hopper the clay in its powdered condition is fed to the moulds, of which there are four. A pressure of about 160 tons is then brought upon the clay in the dies by means of an upper and under set of toggles, which give about one ton per square inch pressure upon the bricks being formed. As soon as the pressure ceases the bricks are by a cam arrangement pushed forward from the moulds and delivered on to a table in front of the machine, whence they are removed by the attendant, who places them on a barrow, and they are wheeled away to the kiln.

The Mineral Resources of New Brunswick.

BY PROF. L. W. BAILEY, OF THE GEOLOGICAL SURVEY OF CANADA.

(Written for the REVIEW.)

New Brunswick has, as yet, certainly established no claim to prominence as a mineral producing country. This is the more remarkable as within her borders are not only to be found those geological formations which elsewhere are usually the seat of valuable ore deposits, but these occupy extensive areas, and present features in the way of plication, metamorphism, granitic and igneous intrusions, which would greatly enhance the probability of the occurrence of such deposits. It is, however, to be remembered that very large portions of the Province, and particularly those which might be expected to be metalliferous, are still densely forest-clad, and that while the limits and age of the different rock formations have been worked out and mapped with a considerable degree of accuracy by the officers of the Geological Survey, but little has yet been done in the way of intelligent and systematic prospecting.

It is proposed to give here a brief summary of what is known as to the distribution of useful minerals in New Brunswick, of such attempts as have been made to develop them, and of the directions in which further effort may be reasonably made.

Coal.—In no instance has the contrast between confident and even extravagant expectation and actual results been more forcibly illustrated, so far as New Brunswick is concerned, than in the case of this mineral. First recognized as occurring here at a very early period in the settlement of the Province, the reports of the earliest Geological Survey, under Dr. Gesner, led to the most exaggerated statements as to its amount and value. A very large area, comprising fully one-third of the entire area of the Province, was indeed correctly shown to be occupied by carboniferous strata, but the fact that these lie nearly horizontally, and may therefore possess a great superficies with but little thickness, if recognized, was not taken sufficiently into account, and for many years no attempts were made to ascertain the real depth of the formation, or the number and character of its seams of coal. In the meantime a greater or less amount of coal continued to be obtained from the locality in which it was first discovered, near the head of Grand Lake in Queen's County, the seam at this point being about 22 inches in thickness, and spreading horizontally over a considerable area, at a distance of only a few feet from the surface. At the same time a confident expectation was entertained by the residents of that vicinity that other and thicker seams might be found at greater depths below the surface, this belief being largely based on the alleged results of certain borings in which a record was made, at a certain depth, of *eight feet of coal and shale*, the relative amount of each not being stated. In consequence of this belief and prevailing uncertainty, a more careful examination of the region was undertaken in 1872 by the Geological Survey, and supplemented by numerous borings, with the result of showing conclusively that the total thickness of the Grand Lake or Newcastle basin could not exceed six hundred feet, and that the 22-inch seam already referred to was the only workable one in the region. At the same time the total amount of coal, supposing the seam to be continuous over the entire basin, as indicated by various outcrops, would be large, amounting to not less than 154,000,000 tons, while its general proximity to the surface would greatly reduce the cost of its removal.

The Grand Lake product is a bituminous coal, of the coking variety, igniting readily, but requiring frequent stirring for complete combustion, and yielding a rather large percentage of ash. It is capable of yielding about 8,500 cubic feet of gas per ton, but of inferior quality, and is not used for this purpose. It has been principally employed as a house coal and for manufacturing, and is especially adapted for blacksmith's use. The annual product amounts to about 6,000 chaldrons, and its market value from $5.00 to $7.00 per chaldron.

As regards other portions of the extensive carboniferous area of the Province, the facts so far ascertained are unfavourable to the belief that important coal deposits are likely to be found. Small seams do indeed occur at many localities, but the general character, relations, and fossils of the accompanying strata indicate that these belong generally, if not wholly, to the lower or Mill-stone Grit division of the series, and are too thin to warrant working.

Albertite.—Though at present apparently exhausted, no mineral found in New Brunswick has awakened greater interest or has possessed a higher pecuniary value than this. First discovered in the year 1850, as occurring a few miles distant from the town of Hillsboro, in Albert County, its development was for some time retarded by litigation, arising out of the disputed ownership of the mine—a dispute involving the consideration of the nature of the mineral itself, whether this was coal or asphalt—but immediately after the settlement of this difficulty, its prosecution was so rapid and its value found to be so great, that in the course of the years 1863-1865, the annual export amounted to from 18,000 to 20,000 tons, worth at Hillsboro ftom $20.00 to $22.00 per ton. This very high spot value, as compared with ordinary bituminous coal, finds its explanation in the nature of the mineral, and the consequent uses to which it was found to be applicable. Though pronounced, at the time of the litigation referred to, to be a true coal, and since generally so called, the facts as to its mode of occurrence, its physical and chemical characteristics and its associations, all indicate that although not identical with asphalt (differing in solubility and some other respects), it is more nearly related to this than to coal, and is of the nature of an oxygenated hydro-carbon, derived probably originally from veins of fluid petroleum. Its mode of occurrence is quite like that of ordinary veins, being sometimes coincident with the bedding, but as often oblique or at right angles to the latter, besides varying greatly in thickness in different parts, and sending off innumerable smaller veins or veinlets, sometimes forming a complete network of the latter. The principal deposits, those of the Albert mines, occur in highly bituminous and petroleum-bearing shales, situated at or near the base of the lower carboniferous formation, and these are undoubtedly the original source of the mineral, but smaller veins are occasionally found penetrating both underlying and overlying strata.

The maximum thickness of the vein at Hillsboro, as found near the surface, was 22 feet, and was found to occupy a nearly vertical fissure, which was mined to a depth of over 1,400 feet. The mineral is jet black in colour, highly lustrous, breaking much like asphalt, and entirely destitute of stratification, being also destitute of microscopic structure, and of uniform quality throughout. It softens under the influence of heat, and ignites readily, burning with a sooty flame. Subjected to distillation it yields 100 gallons of oil per ton, and of gas about 14,500 cubic feet, the latter being of superior illuminating power. From it a burning oil, known as Albertine, was for a time manufactured, but its principal use was an enricher in gas manufacture, for which it was highly esteemed.

The decline of the Albert mine was as remarkable as its development. As early as 1870 indications of diminished supply began to be observed, and though every effort was made to ascertain the possible existence of other deposits of similar character in the immediate vicinity, these were found unavailing, and the mine, having been practically exhausted, was in 1879 finally abandoned. In the meantime, however, similar explorations were carried on at more remote points, chiefly by boring, while a careful survey of the area was undertaken by direction of the Dominion Government, and all available information bearing upon its further occurrence obtained and published. These surveys resulted in demonstrating the existence of Albertite veins at widely separated points, in connection with the enclosing Albert shales; but these were in all cases very small, and though considerable sums have in some instances been expended in proving them, they have in no instance proved remunerative.

Anthracite.—This mineral is found to a limited extent in the Devonian rocks of St. John County. In many instances it is evidently the result of the alteration, wholly or in part, of the individual trunks of fossil trees *(Dadoxylon)* scattered through the sandstones of the Devonian formation; but in a few cases the vegetable accumulations would seem to have been such as to give rise to actual beds of coal, though of no great thickness. The best known locality for these beds is that of Lepreau Basin, near the western border of St. John County, and not far from the mouth of the Lepreau River. A seam of mixed coal and shale is here met with, having a total thickness of fifteen feet; but the shale is irregularly distributed through the coal, and the latter, where purest, does not exceed a thickness of four feet, while it also contains much earthy matter. Analyses of samples from the outcrop, made by Dr. Harrington, gave 36·88 per cent. of ash. The beds at this locality are all highly disturbed, and the area over which they are distributed but small.

Bituminous Shales.—The bituminous shales or pyroschists which have been referred to as holding the mineral Albertite, constitute in themselves also, to some extent, a source of combustible material.

These shales are found at or near the base of the lower carboniferous formation in Kings, Albert, and Westmoreland Counties, where they form two or more belts, with a total length of fifty miles, and with a surface breadth rarely exceeding half a mile. They are remarkably fine-grained, dense and tough, varying in colour from dark grey to jet black, susceptible of polish though possessing little lustre, and emitting, especially when rubbed, a decidedly bituminous odour. At times they approach the character of a true cannelite, while at others they are saturated with petroleum. They contain also a considerable pro amount of calcareous matter, and in certain layers abound in the remains of fossil fishes. In attitude they are usually much disturbed, their inclination at most points being high or even vertical, with numerous and abrupt plications.

Some twenty years ago an attempt was made to employ these shales in the distillation of oil, and works for the purpose were erected at Caledonia, in Albert County, about three miles distant from the Albert mines; but the product being unable to compete successfully with the enormous yield of natural oils then first brought to notice in Pennsylvania and elsewhere, these were soon abandoned. The yield of the richest bed at this point, known as the Black Band, and having a thickness of about seven feet, was 63 gallons per ton, while of somewhat similar beds on the Memramcook River, in Westmoreland, the yield was 37 gallons per ton. From the latter locality about 2,000 tons were removed in the year 1865, and are said to have sold, in the United States Market, at the rate of $6.00 per ton. The gas producing capacity of the Black Band shales was 7,500 cubic feet per ton.

Petroleum.—The Albert shales have been described as not only yielding oil upon distillation, but as containing a certain proportion of such material, naturally produced. The amount of petroleum thus contained varies considerably, and only rarely is in sufficient quantity to become visible. During the course of the operations at the Albert mines, drops of oil were sometimes seen oozing from the walls of the galleries, more particularly from the sandy beds, associated with the shales, and it has also been observed at Upper Hillsboro, Belveau, Memramcook and Dover. At some of these points attempts have been made to collect the oil, but so far the flow of the latter has in each instance proved too slow to allow of profitable collection. In the case of the locality at Dover, the oil in coming to the surface in connection with a spring of water becomes slowly oxydized and hardened into a pasty semifluid and elastic mass, resembling pitch, and known as maltha. The oil-bearing strata frequently emit jets of inflammable gas.

Gypsum.—Gypsum is one of the most abundant of the economic minerals of New Brunswick, occurring in beds of great extent and thickness near the top of the lower carboniferous formation, especially in Albert, King's and Victoria counties.

The deposits which have been longest known and most extensively worked are those near Hillsboro, in Albert County, being the property of the Albert Manufacturing Company. The total area occupied by the plaster beds in this vicinity is not accurately known, but from the position and relation of the several quarries, it seems certain that this is quite large, while the exposed thickness of the bed varies from seventy to one hundred feet. Of this, however, a portion is anhydrite or hard plaster, the associated gypsum being mostly a pure white or slightly clouded alabaster, which is occasionally translucent, but more generally opaque. Small crystals of selenite occur in some portions of the mass, but are comparatively rare. The rock is distinctly stratified, and usually accompanied by limestones.

For some years the Hillsboro plaster was employed only for exportation in the raw state, but in 1861 works were erected for its calcination, and since that time have been kept pretty steadily in operation, supplying both the burned and unburnt product. The productive capacity of these works (in 1876) was 600 lbs. per day, giving employment to about 100 hands.

Of other localities containing workable beds of gypsum, one occurs upon the North River, a few miles from Petitcodiac Station on the Intercolonial Railway. It is remarkable, in contrast with that of Hillsboro, in being highly crystalline, nearly the whole mass, about 40 rods in breadth, being granular or fibrous, while a vein of coarsely crystallized selenite, from six to eight feet in diameter, is traceable through the mass for a distance of a mile or more. A large quantity of gypsum has been removed from this locality, but has not been subjected to calcination. Large and valuable beds of gypsum also occur upon the Tobique River, in Victoria County, but are less pure than those of Albert County.

Antimony.—Ores of this metal have been observed in several localities in New Brunswick, but the only one in which it is known to occur in quantity is that of Prince William, about twenty-four miles from Fredericton, and about four miles distant from the St. John River. It is here found in connection with a series of slates and sandstones believed to be of Cambro-Silurian age, and which, within a mile of the mines, are invaded by a great mass of intruded granite, by which they have been made to assume more or less of a crystalline character. Numerous quartz veins, from one-eighth of an inch to six feet, intersect these slates and sandstones, and most of them carry more or less of the metal. This is chiefly in the form of the sulphuret or *stibnite*, but in the course of the workings, native antimony was also met with to some extent.

The Prince William locality first came into notice about the year 1862, soon after which several companies were formed for its development. The first of these to undertake active operations, was the Lake George Mining Company, by whom a considerable quantity of ore was raised, while at the same time somewhat expensive works were erected, embracing crushers, rollers, jiggers, etc., as well as furnaces for desulphurization and smelting. When in full operation, these works yielded fifteen tons of metal every six weeks, the charges (of 500 cwt.) affording from 45 to 55 per cent of regulus. The product was partly exported in cakes or ingots to the United States, and was partly employed on the ground in the manufacture of Babbit metal by admixture in the proportion of twenty per cent. with lead, copper and tin. The value of the regulus was quoted on the ground at 12 to 14 cents per pound; that of the Babbit metal, according to quality, from 20 to 50 cents per pound.

The above works were somewhat interruptedly carried on for several years, but it was finally found or thought to be unprofitable to continue the manufacture, and they have since been idle. In the meantime several other companies have purchased leases in the vicinity, and through the rivalry of these, together with frequent changes of ownership and consequent litigation, the development of the whole locality has been greatly retarded. In October, 1883, about eighty men were employed in the Brunswick mines, (at wages varying from $1.30 to $1.50 per day), and during five months of that year about 29 tons of ore were sent off, chiefly to Medford, Mass., where it was largely employed in the vulcanization of rubber. Soon after this, however, the works were suspended and have not since been resumed. It is said that not less than $400,000 have been expended at this locality since the first commencement of mining operations.

Native Antimony. — This mineral accompanies the sulphide of antimony or stibrite at the Prince William or Lake George mines in York County, described above, but is relatively rare. It is found both massive and crystalline, and some of the specimens obtained here are very fine.

In addition to the locality in Prince William, gray antimony ore has been observed at several other points, as in Canterbury, York County, and Springfield, King's County, but only in small quantities.

Manganese.—The principal deposits of manganese are those of Markhamville, King's County, being about twelve miles south of Sussex Station, on the Intercolonial Railway. As is usually the case they here occur in connection with limestones lying at or near the base of the lower carboniferous formation, though also sparingly found in the underlying Huronian rocks. Their distribution is characterized by great irregularity, the ore being distributed through the limestone chiefly in the form of pockets, some of which are small, but others remarkable for their large size and purity. The ore itself embraces many varieties, though chiefly consisting of pyrolusite, both massive and crystalline, and is not infrequently associated with limonite and barite. The mines at this locality were first opened in 1863, since which time about 20,000 tons of ore have been removed, the annual production varying from 500 to 1,500 tons. The price, delivered at Sussex Station, varies according to quality, from $15 to $50 per ton.

A second locality in which manganese ores have been found in sufficient quantity to warrant their removal, is that of Shepody Mountain, in Albert County. From this place considerable quantities of ore have been removed at different times, and preparations are now in progress for a renewal of operations in that vicinity.

A deposit of manganese also exists upon the coast, not far from the Quaco Light, but so far as known to the writer is of but small extent and value.

Molybdenite.—Molybdenum sulphide, or molybdenite, has been observed in New Brunswick at several localities, but chiefly in connection with the gneissic and micaceous strata, which border the great central granitic axis of the Province, or in the granite itself. It has been thus found near St. Stephen, in Charlotte County, near the granite belt in York County, and below the Pabneau Falls on the Nepisiquit River in Gloucester County. At the second of these localities it appears to be quite abundant.

Lead and Silver.—Sulphurets of lead, carrying more or less of silver, have been observed at a number of localities in New Brunswick, and in some instances have been mined to a limited extent, but as yet without profitable returns. The most promising of these localities appear to be in Gloucester County, and not far from the line of the Intercolonial railway. On Rocky Brook, a branch of the Nepisiquit Millstream, in this County, a vein of quartz has been recently observed, which, according to Mr. Edward Jack, is about 20 feet wide and carries from wall to wall more or less galenite and pyrite, an assay of which, made by Prof. H. O. Hoffman, of the Massachusetts Institute of Technology, yielded, of silver, 11 oz., and of gold 0.24 oz. to the ton of 2,000 lbs. avoirdupois. An analysis of other samples from the same vein, made by Prof. Ricketts of New York, yielded 14.20 oz. troy, per 2,000 lbs. of the ore, as submitted.

Graphite.—Graphite or plumbago, in a finely divided state, is not unfrequently disseminated through the altered rocks of the older formations to which it imparts a dark colour and more or less glossy aspect. It is most abundant in connection with the pre-Cambrian rocks which are believed to represent the Laurentian system in St. John County. Much of the limestone of this formation is dark gray or even black from this cause, while in places the graphite assumes the form of veins, pockets or well defined beds. A band of this character crosses the mouth of the St. John River at the Falls, and is traceable both east and west for several miles. Mining operations for its removal have been frequently undertaken, and at one time (1868-1870), about 6,000 barrels per year, averaging when crushed and screened about 4 cwt. to the barrel, were removed. The beds vary in thickness from one to four feet. The mineral itself is somewhat impure and incapable of being directly applied to the uses for which the finer qualities of graphite are employed, but has been found to answer well for foundry facings, stove polishes and the like, and by appropriate treatment can be rendered available for other purposes as well. Quite recently these mines have been re-opened.

Of other formations containing considerable quantities of graphite may be mentioned the Cambro-Silurian and the Devonian. The slates and schists of the former, as found near St. Stephen and elsewhere in Charlotte County, and in the parish of Canterbury, York County, are often highly plumbaginous, but neither in these nor in the Devonian are there any known deposits of economic value.

Gold.—The amount of positive information regarding the presence of this metal in New Brunswick at present possessed is very small. Reports of its discovery have indeed been frequent, but in the very few instances in which these appear to have emanated from reliable sources the amount of gold observed has been so small as to discourage further efforts to obtain it. While, however, the amount of the metal actually obtained is thus insignificant, it is worth while to notice that rocks very nearly resembling those of the auriferous belt of Nova Scotia, and believed to be of the same age, are largely developed here, and further, that it is in connection with these same rocks that very many of the reported discoveries of gold have been made. The rocks referred to are those composing the slate and quartzite belts which border the great central granitic axis of York and Northumberland counties, and which with the latter traverse the entire breadth of the Province. Much of this region is still densely forest-clad and difficult of access, but should any portion of it prove to be auriferous the discovery would be of inestimable value to the Province, as helping to open up an extensive region otherwise likely to remain permanently in a wilderness condition. Among the points at which gold has been reported in small quantities may he mentioned the vicinity of the St. Croix River, in Charlotte County, the Nashwaak River above Stanley, in York County, the Muniac River, in Carleton County, and the Serpentine River, in Victoria County.

Copper.—The ores of copper found in New Brunswick include native copper, copper glance, chalcopyrite or copper pyrites, bornite or erubescite, cuprite and malachite.

Native Copper—Has been reported as occurring sparingly in connection with the triassic traps which form the northern half of the island of Grand Manan. It has also been observed at Clark's Point on the Mascarene shore of Passamaquoddy Bay, and is stated to have been found in small quantities along the coast, near the head of the Bay of Fundy. Little that is definite, however, is known of either locality.

Copper Glance—Accompanies the native copper in the traps of Grand Manan, where it has been described by Prof. E. J. Chapman as being snfficiently abundant to give promise of profitable extraction. Little effort, however, has as yet been made in this direction. The same mineral, and in larger quantities, has been found associated with other copper ores at different localities along the coast of Charlotte County, and on the adjacent islands, among which may be mentioned Crow Harbor Island, Simpson's and Adams' Islands. It is, however, a less abundant mineral than the species next described.

Copper Pyrites or Chalcopyrite—Is the most widely distributed as well as the most abundant of the copper ores of New Brunswick, and has been observed at many localities. The larger number of these occur along the southern sea-board, where a band of copper-bearing rocks, believed to be of pre-Cambrian age, is found to extend, with some interruptions, along the greater part of its length. Others are found in the interior, more particularly in connection with the older schistose rocks or the intrusive masses by which these have been invaded. A detailed list of these localities so far as they occur in the southern part of the Province, will be found in the Report of Progress of the Geological Survey for 1870-71. In the northern part of the Province, the most noticeable localities are Bulls Creek in the vicinity of Woodstock and the Tattagouche River, near Bathurst. In Westmoreland County, ores consisting in part of this species occur in connection with rocks of the carboniferous age, near the town of Dorchester.

Bornite or Erubescite—Sometimes known as peacock ore, accompanies the other ores of copper, more particularly about Passamaquoddy Bay and the head of the Bay of Fundy, sometimes occurring to the exclusion of other varieties. Where abundant, it constitutes a very valuable source of the metal, and the ore of some of the most promising mines yet opened has been chiefly of this species.

Nickel—Considerable deposits of pyrrhotite have for many years been known to occur in different portions of Charlotte County, usually in connection with copper pyrites, but until recently have been considered to be without value. Attention, however, having been re-directed to them in consequence of the developments at Sudbury, in Ontario, these also have been found to be nickeliferous, and attempts are now being made to test their value. The deposits appear to be large, but, as at Sudbury, the nickel contents vary considerably. A fair average sample of 72 lbs., analysed under the direction of Dr. Hoffmann, of the Dominion Geological Survey, yielded nickel, 1.718 per cent., the material very closely resembling, according to Dr. Hoffmann, a large proportion of the ore found at Sudbury, Ont.

Building Stones—Very extensive and valuable beds of granite freestone, slate, marble, etc., exist in the Province, and in the case of the first two have been largely quarried for exportation, but have not been thought to require extended notice in the present connection. The same is true of a number of other rocks or minerals, including limestone, clays, intusorial earths, bog-ores, salt, &c. These may be made the subject of a subsequent contribution.

Iron—All the usual ores of iron occur to some extent in New Brunswick, including hematite, limonite, siderite or spathic iron, and magnetite, though none are now employed as a source of the metal, By far the largest deposits are those of hematite, or mixed hematite and limonite, which form extensive beds near Jacksontown, north of Woodstock, in Carleton County. They may be traced across the greater part of this county in parallel and closely associated bands, and vary from 2 or 3 to 15 feet in thickness. Somewhat extensive operations were at one time (1848-1865) carried on near Woodstock, in the smelting of the ore, and a charcoal iron manufactured, which, for certain purposes, was highly esteemed. This was no doubt due to the fact of the ore naturally containing a considerable percentage (1·6 per cent.) of manganese, thereby adding materially to its tensile strength. It was, however, on the other hand also contaminated with a considerable amount of phosphorus (one analysis yielding 1·298 per cent. of phosphoric acid) and therefore apt to be cold short in a high degree. According to the report of Dr. Ells, of the Geological Survey, there were ten charcoal kilns, with an average capacity of 75 cords of wood, and a production of 2,800 to 3,200 bushels of coal. The quantity of ore used was, on an average, 3 tons to the ton of pig, and the cost at the furnace $1.20 per ton; 126 bushels of charcoal were required per ton, at a cost of 7 cents per bushel, and the cost of pig produced was $20 to $22 per ton.

The history of the Woodstock mines was a somewhat checkered one, but too lengthy to be reproduced here. It is sufficient to say that after several stoppages and resumption of operations under the different parties, the works were closed down several years ago and have not since been resumed.

Limonite—In addition to the limonite referred to above as associated with the hematites of Carleton County, this same mineral is found at various localtties in the form of bog ore. The largest deposits are upon the banks of the St. John River, at Burton, in Sunbury County, and considerable quantities of the ore were removed during the continuance of operations at Woodstock, for admixture with the hematites of that locality.

Spathic iron is only known to occur in the form of small veins in certain portions of Queen's and Charlotte Counties.

At West Beach, twelve miles east of the City of St. John, upon the shore of the Bay of Fundy, are beds consisting of red hematite mingled with specular iron ore, while at Black River, two or three miles east of West Beach, are beds of the last named mineral, some of them with a thickness of 20 feet. They have not, however, as yet attracted the favorable notice of such iron experts as have visited them.

Magnetite is not uncommon in the form of scattered grains in the crystalline rocks of the southern counties, and small veins are sometimes met with, but none has as yet been observed sufficiently large to warrant any attempt to remove them.

MINING NOTES.

[FROM OUR OWN CORRESPONDENTS.]

Nova Scotia.

Cumberland County.

The new bank-head of No. 2 slope is about finished, and was connected on Wednesday the 18th. The Springhill collieries are working briskly. The output is about 1,600 tons daily and upwards. It is stated that another fault has been encountered in sinking No. 2 slope.

Considerable prospecting is being done in the vicinity of Springhill Junction. Mr. James W. Hickman, of Amherst, has a gang of men employed. A reported discovery of a six-foot seam some time ago is not confirmed.

A diamond drill is at work near Maccan station. Two holes have been put down about 600 fect on areas owned by R. G. Leckie and others. Another hole is now being sunk. The drill is working splendidly and it is probable that the owners will be rewarded by a valuable find of coal in that locality.

Judge Morse, of Amherst, and others are manifesting an interest in the reported asbestos discovery near Five Islands, in Colchester Co. They are disposed to invest some money to test the quantity and quality of the asbestos deposits there. The owners are confident that their property is valuable.

The Joggins Colliery is taxed to its utmost capacity. The quality of the coal has greatly improved, and there is a firm demand for this coal for domestic and steam purposes. The colliery has been enlarged and improved. From one slope the output is now 400 tons daily. Several railways are now being supplied with Joggins coal.

James Baird, manager of the Joggins Colliery, is greatly encouraged by the opinion of experts on his new railway frog, one of which is in use on the I.C.R. at Maccan station.

Dr. J. A. Byers, of Springhill, has invented an improved monkey wrench, from which he expects good results.

The water in the pits this season has been exceptionally heavy. In order to keep the rest of the pit clear, the sinking in No. 3 slope was flooded. The new pump will likely be started this month. This pump is the largest in the Springhill collieries.

New Brunswick.

My notes this month must be necessarily brief, as very little has been done in mining matters of late. Still every few days rumours of new finds and formation of local syndicates for purpose of exploration and development are heard of.

The action of American capitalists who hold bonds or options on a number of areas in St. Stephen, is anxiously watched for, as their time expires somewhere near the middle of the present month. Should they take the properties in question and pay the bond prices, it will be a confirmation of the supposed value of this nickel deposit in St. Stephen, which would be of great importance to the mining interests of New Brunswick.

It has also been rumoured that a valuable find of antimony has been discovered in Milltown, near same locality as the nickel-pyrites properties.

At Memramcook, in Westmoreland County, a gravel pit, formerly used for ballasting the Intercolonial Railway, has been found to contain marked evidences of gold; whether in paying quantities or not has yet to be demonstrated. It is reported that some Halifax and American capitalists will put in sufficient machinery at an early day to properly test the property.

Work of development on some galena or silver-lead properties in Gloucester County, is lately reported, and it is said that the indications are fairly favorable.

A number of St. John gentlemen have taken interests in some Nova Scotia gold mines which are reported as being quite valuable. How far this is correct remains to be demonstrated; but one cannot help regretting that these same gentlemen cannot see their way clear to investing some of their spare dollars in the development of our own Province minerals. Perhaps they may do so later on.

The latest information of importance is the statement of a gentleman named Prof. W. J. Roberts, who has been connected with the search for and development of anthracite coal in Musquash, not very far distant from St. John, and should it prove correct, it will undoubtedly be of vast importance to the Province generally, and St. John particularly. He reports that operations will be commenced in April next, when new shafts will be put down and the production of coal gone on with vigorously. Prof. Roberts says the coal obtained is the very best of anthracite, and he expects Musquash to become one of the important coal centres of America. Prof. Roberts belongs to Pennsylvania, but before returning home will examine some property near St. Andrews, on which there is said to be evidence of gold in paying quantities. He says New Brunswick is undoubtedly an undeveloped mineral country, and we trust his ideas are correct and that we may soon have some of the hidden wealth brought to light.

Work at the Plumbago mine, near the St. John suspension bridge, is being carried on regularly, and good quantities of plumbago obtained constantly. The owners are shipping it regularly and seeking new markets for it. The plumbago is said to be of a very good quality indeed.

There is not anything further of importance in the mineral line at present that I am aware of, but shall keep a bright look out on what is being done, and inform you of the progress in this direction from time to time.

Quebec.

Eastern Townships.

As agreed upon at the recent meeting of the mining companies, the following mines closed down on 31st ulto.: King Bros., Johnson Co., Ward, Ross & Co., Beaver Asbestos Co., all of Thetford; the American Asbestos Co., Glasgow and Montreal Asbestos Co., King Bros., Central Mining Co., Reed's mine, Steel, Macdonald & Co., all of Black Lake. By this action a very large mining population will be thrown out of employment during the hardest months of the year, and the trade of the vicinity will be seriously affected. The people will doubtless remember to whose blundering legislation this unfortunate result has in very large measure been brought about. The sooner the government repeal their obnoxious Mining Bill, the better for themseves and us, is the sentiment hereabouts.

At Thetford, the only asbestos mines at present working are those of the Bell's Co. and the Thetford Mining Co., but it is understood that these, too, will soon be closed also.

At Black Lake, the Anglo-Canadian and the United Asbestos Co. are still in operation completing some outstanding contracts. The end of this month will see both of these properties shut up. In consequence of the universal stoppage of work here there is absolutely nothing to communicate to your readers.

Mr. E. Wertheim, managing director of the American Asbestos Company, left on 5th instant *en route* to Germany, his headquarters. His many friends here wish him a pleasant trip and speedy return.

Mr. Wm. Foerster, of Messrs. Wm. Foerster & Co., Hamburg, spent a couple of days visiting the mines here. He handles considerable quantities of Canadian crude yearly.

The next meeting of the Asbestos Club will be held at Black Lake on 26th instant, when a paper will be read by Mr. B. T. A. Bell, editor of the *Canadian Mining Review*.

Captain Richard Penhale, of the Albert Mines, whose health for some time past has been far from good, has gone south. The Review hopes to see Captain Penhale back to Capelton thoroughly restored to good health by the holiday.

On 30th instant a trammer named Joseph Allard was struck by a fall of rock in the Eustis Mine and instantly killed. At the inquest a verdict of accidental death was returned.

Templeton District.

Dr. Hjolmar Lundbohm, of the Geological Survey of Sweden, spent two or three days last week in the district examining the mines being worked.

Owing to the S.S. Amarinthian having to put back to Glasgow, by an accident to her machinery, she did not make her last trip to Montreal. This has prevented the shipment of about 300 tons of phosphate leaving Montreal as anticipated.

The Templeton Asbestos Company are erecting a large boarding house on their property, which will be completed early next month. Their principal work is now being done on the shaft which is now at a depth of 85 feet. The vein of asbestos is improving considerably, a quantity of inch to inch and a quarter of high quality now being produced.

The East Templeton District Phosphate Mining Syndicate are sinking two shafts on the hill back of their buildings. One of them, at a depth of about 50 feet, shows a well-defined vein the length of the pit by about 4 feet wide. In the old Blackburn "Big Pit" a drift is being run at the base of the old workings (140 feet down) which will connect with the shaft sunk last winter. The monthly output continues as large as formerly.

While working on a slope in the "Big Pit," at Lomer's mine, last month, the pit foreman, Eli Burt, a man about 35 years of age, was killed by falling rock. An inquest was held by Coroner Graham, of Hull, and a verdict was given by the jury that deceased came to his death by accident, and that no blame attached to the proprietors or management. The deceased leaves a widow and three children in Newfoundland.

A large meeting was recently held at Perkins Village for the promotion of a railway from East Templeton station to Portland West. Resolutions were passed favoring the petitioning of the Quebec Government subsidizing the same.

The old roadway through the Canada Industrial Company's lot, "The Post Mine," has been closed, and two or three fine shows of Phosphate exposed. About 50 tons of No. 1 were taken out last month with a small gang of men.

Pontiac County.

Owing to the presence of sulphur in the Bristol ore it is calcined before shipment, and while the mine is said to be capable of putting out some 60,000 tons of raw ore per annum, the quantity raised is limited by the roasting-kiln capacity to about 30,000 tons a year. By reason of the existing depression of the American iron trade the mine is not being operated at present, and though melters of ore look forward with confidence to 1892 for increased activity and profitable business, Canadian iron-ore raisers—primarily handicapped by a burdensome duty of 75 cents per ton—will have difficulty in marketing their product unless Canadian railroads meet them with helpful freight rates, and the Government abrogates its absurd royalty act.

Ontario.

Taylor Bros., Toronto, who own paper mills and pressed brick works on the Don river, near the city, have discovered extensive deposits of fire clay on their property, and will immediately erect works for manufacturing the article into fire brick, sewer pipe, etc.

Feldspar rock, described as an orthoclase, with sparsely disseminated fragments of quartz, to the amount of 300 tons, has been shipped from Whitefish Lake, County of Leeds, by way of Kingston to Cleveland.

Some Kingstonians have been speculatively acquiring various beds of talcose rock in the vicinity of Madoc, Ont.

Sudbury District.

It is currently reported that the Blezard and other properties owned by the Dominion Mineral Co. have been sold. The price is stated at $2,000,000, but at date of writing the rumor is not authenticated.

Dr. Bell's report on this district has not left the printer at date of writing; the map has, however, been issued.

GOLD MINING SUPPLIES.

The principal depot in Nova Scotia, carrying the most complete assortment of first-class goods, is

H. H. FULLER & CO.'S

41 to 45 Upper Water St., Halifax, N.S.

Our line comprises Explosives, Fuse, American and English Mill and Hammer Steel, Bar and Bolt Iron, Steel Wire Hoisting Rope, Hemp and Manilla Rope, Rubber and Leather Belting, Miners' Candles, Oils and Lamps, Miners' Tools, Machinists' Tools, Blacksmiths Tools, and every requisite for the gold miner.

H. H. FULLER & CO.,
Halifax, N.S.

Port Arthur District.

The East End Silver Mountain made a few days ago a shipment of ten barrels of silver ore to the Balbach Smelting Works at Newark. Three barrels are from the new vein, which is reported rich in silver, while the remainder is from the old workings. Work is to be greatly extended at this mine in the spring.

Work at the West End Mine recently cross-cut a new vein which shows rich in silver. Drifting was immediately begun and latest reports announce that the silver continues as rich as when first discovered. Prospects are reported to be bright at Silver Mountain.

British Columbia.

The coal shipments for month ended 30th October last were :

New Vancouver Coal Co........	27,345 tons.
Wellington....................	23,149 "
East Wellington...............	1,900 "

An examination of candidates for manager's certificate of competency under the Coal Mines Regulation Act, 1887, was held at Nanaimo on 12th inst.

Mr. W. H. Irwin, of the firm of Irwin & Hopper, Montreal, has returned from a visit to the Tam O'Shanter and other claims in the Kootenai District owned by his company (The Montreal & Kootenai Mining Company). A shipment of ore will be made this fall from the Tam O'Shanter to the smelter at Tacoma. Mr. Irwin speaks enthusiastically of the prospects of the district.

Mr. Edward Watts returned last week from the Toad Mountain District, B.C., where he has located two silver claims for an Ottawa Syndicate. Mr. Watts thinks that with railway facilities in a few years that district will be the most important one in Canada for silver mining. The two leading claims on which a considerable amount of development work has been done during the past two seasons are the "Silver King" and "Dandy." In the former a sink of about 35 feet has been made, and the vein exposed shows a width of over 40 feet. A bona fide offer of $1,300,000 was refused, the proprietors, Messrs. Hall Bros., contending that with nearly $200,000 worth of ore on the dump and six times that much in sight, was more valuable than the consideration offered. A good waggon road has been made to the mine at a cost of about $7,000. The Dandy mine in close proximity cost the present owners $175,000. The ore in both these claims yields from 300 to 1,500 oz. per ton, at a depth of 18 to 20 feet. The belt is about 20 miles long and nearly 2 miles wide.

The cross-cut tunnel in the Dandy has cut the north ledge, the ore being of the same grade as that taken from the bottom of the shaft. It is expected that the main ledge will be cut in less than 35 feet, and if it is, the Esler Company will have proved that the great Silver King ledge goes down at least 700 feet (as if a drift was run from the cross-cut tunnel on the Dandy to the east end line of the Silver King a depth of fully 700 feet would be obtained). On the Dandy the north ledge is not more than 8 inches wide on the surface, the vein matter being low grade. Where cut in the cross-cut tunnel there is a foot of good ore and fully 3 feet of vein matter. This, to say the least, is encouraging, and the Dandy people are elated over the fact that their "lucky" superintendent, E. C. Ray, is likely to add another good mine to their list of paying properties. The entire force are now at work in the cross-cut tunnel, pushing it ahead, also drifting both ways on the ledge. Some of the more sanguine of the people at Nelson expect to see work commenced on a concentrator at the Dandy within a month.

The hoist has been placed in position at the Krao mine, and superintendent McDonald reports it to work as smoothly as if it had been running for a year. The shaft was found to be unsafe, and it is being re-timbered. The pump has not been started up, the water in the shaft being handled with buckets. The Krao is looked on as one of the most promising properties in Hot Springs district, and is owned by McCune, Giegerich & Hoge.

CANADIAN COMPANIES.

The Kingsley Steam Boiler Company.—Letters patent, under the New Brunswick Joint Stock Companies Act, have been granted to this company under date of 6th November. Capital stock, $25,000, divided into 500 shares of $50 each. The directors are : Howard D. Troop, St. John, N.B. ; James C. Robinson, George W. Jones, George Kingsley and Chas. McL. Troop, all of St. John. The company will manufacture steam boilers, &c.

The McNaughton Gold Mining Company.—This company, of which some notice was given in our last issue, received its charter of incorporation under the New Brunswick Joint Stock Companies Act on 6th inst.

The Pictou Charcoal-Iron Company, (Ltd.)—The purposes for which incorporation is sought under Nova Scotia Joint Stock Companies Act are the manufacture of charcoal pig iron, and any other business in connection with and incidental to such manufacture ; to develop and operate mines ; to erect, operate, lease, sell and convey furnaces for roasting and reduction of ores and the smelting of iron ; to manufacture coke and charcoal, wood alcohol and other products derived from the distillation of wood ; to construct and operate mills, factories, charcoal foundries and steel mills, forges, shops, gas works, &c. The chief places of business to be at Bridgeville and New Glasgow, in the County of Pictou, Nova Scotia. Capital stock, $200,000, in $1 shares. Directors: W. B. Moore, New Glasgow ; D. Roy Grant, New Glasgow ; E. A. Sjostedt, metallurgical engineer, New Glasgow ; A. Markham, St. John, N.B., and J. N. W. Winslow, Woodstock, N.B.

The Taylor Decarbonized Iron and Manufacturing Company.—This company gives notice of application for charter under the Dominion Companies Act. Capital, $150,000. Head office : Montreal. Directors : F. D. Taylor, M.E., F. Gilbert, F. Workman, all of Montreal. To acquire and work the Taylor process of decarbonizing iron ; to acquire and work other processes for the manufacture of iron, steel and other metals ; to acquire lands containing iron and other minerals and petroleum, not exceeding 20,000 acres, &c.

The Crescent Gold Mining Company of Marmora (Ltd.) applies for charter under Dominion Companies Act. Capital $100,000, in shares of the value of $1 each. Head office : Malone, Township of Marmora, Ont. Directors : P. A. Peterson, C. R. Hosmer, Montreal ; H. C. Hammond and Robert Benny, of Toronto, and J. McFee, Belleville, Ont. Formed to acquire and work mineral lands and estate in the Province of Ontario.

H. W. McNeil & Company give notice of application for charter under Dominion Companies Act, to mine and extract coal, especially anthracite coal, in Canada, and generally to carry on the trade or business of colliery proprietors, miners and engineers, in all their branches, and also the trade or business of carriers, by water, of coal, minerals and other freight, from, to and within Canada. The company at present operates the mines formerly owned by the Canadian Anthracite and Coal Co. at Banff, N.W.T. Capital, $50,000, in 500 sharess of $500 each. Directors ; Hobart W. McNeil, Anthracite, N.W.T. ; F. A. Hill, Seattle, Wash., U.S.A. ; P. P. Padden, Anthracite, N.W.T.

Empire Mining Company of Ontario.—This company seeks a charter under Ontario Statutes, with the object of acquiring and working mineral lands and mines in the Township of Graham, Algoma District, Province of Ontario. Head office : Toronto, Ont. Capital, $75,000, in shares of the value of $100 each. Directors : John Jones, D. Hunter, J. S. Lockie, J. A. Huntley, J. M. McBrian.

Vermillion Mining Company.—At a meeting of shareholders held at the company's office, in Dennison Township, Ont., the following directors for ensuing year were elected : H. B. Payne, Stevenson Burke, John W. Evans, George E. Allen, T. W. Cornell, C. W. Bingham and H. P. McIntosh. The board organized by electing the following officers : president, T. W. Cornell ; vice-president, Stevenson Burke ; secretary-treasurer, H. P. McIntosh.

New Vancouver Coal Mining and Land Company (Ltd.)—The directors, in their report for the six months ended June 30th, state that the directors have declared an interim dividend at the rate of 5 per cent. per annum, payable, tax free, on Dec. 5, to the holders of shares on Nov. 18, 1891.

Cape Breton Institute of Mine Officials.—The following have been elected officers of the Institute during the ensuing year : president, J. G. S. Hudson ; vice-president, Charles H. Rigby ; secretary, S. T. Lee ; treasurer, Daniel Hardy.

Latest Stock Quotations of Canadian Companies in England.

	Price.	
Nicola, Limited, £35,000 fully-paid shares of £1..................	——	
Shuniah Weachu, Limited, £99,888 fully-paid shares of £1..................	——	
Tilt Cove Copper, Limited, £160,000 fully-paid shares of £2..................	——	
Ditto, £80,000 5½ per cent. debentures...	——	
General Mining, Limited, £219,752 fully-paid shares of £8..................	3¾	4¼
Low Point, Barrasois and Lingan, £509,100 fully-paid shares of £100..............	——	
New Vancouver Coal Mining and Land, Limited, £185,000 fully-paid shares of £1	⅝	⅞
Sydney and Louisburg Coal and Railway, Limited, £50,000 cumulative 10 per cent. first preference shares of £10, £6 paid ..	4	6
Ditto, £14,560 fully-paid non-cumulative 6 per cent. second preference of £10......	3	5
Ditto, £250,000 fully-paid ordinary shares of £10..................	¼	¾
Anglo-Canadian Asbestos, Limited, £11,500 fully-paid shares of £1..............	——	
Anglo-Canadian Phosphate, Limited, £46,510 fully-paid preference shares of £10......	——	
Ditto, £25,000 fully-paid deferred shares of £10..................	——	
Bell's Asbestos, Limited. £140,000 fully-paid shares of £5..................	8⅛	8⅛
Ditto, £68,400 debentures, 5 per cent.; interest January 1 and July 1............	——	
Canadian Phosphate, Limited, £100,000 fully-paid shares of £1..................	⅛	¼
General Phosphate, Limited, 5 per cent. ordinary shares of £10, £2 paid...........	——	
Ditto, £5,000 fully-paid founders' shares of £10..................	——	
Leeds, Copper, Limited, shares of £1, with 10s. 6d. paid..................	——	

Nicola.—Accounts to September 30 submitted in November. No dividend yet. Further capital is needed; and operations temporarily suspended.

Shuniah Weachu.—Accounts to November 20 submitted in February. No dividend yet. Shares for £12,870 held by the Company.

Tilt Cove.—In March, 1890, the properties were leased for 99 years to the Cape Copper Company, Limited, at a rent of £4,400. The Cape Copper Company advance £15,000 at 5 per cent. interest, and when this is repaid out of profits, surplus profits are to be divided equally between the Cape Copper Company and the Tilt Cove Company. The lease may be determined by the Cape Copper Company at any time on twelve months' notice. Accounts annually to March 31 submitted in November.

General Mining.—Accounts to December 31 submitte in April, but an interim meeting is held in November. Dividend for 1884, 5 per cent.; for 1885 and 1886, 3⅛ each year; for 1887, £4 13s. 9d. per cent., and for 1888 1889 and 1890, 3¾. Reserve fund, £29,850.

Low Point.—Accounts to December 31. For 1887, 1888, and 1889, 5 per cent was paid each year on the ordinary shares publicly held; for 1888 the ordinary shares issued to the vendors got 3½ per cent., and for 1889, 2½.

New Vancouver Coal.—Reconstructed in 1889. Accounts to June 30 and December 31 submitted in November and May. For the two half-years to June, 1889, 5 per cent. per annum was paid; to December, 1889, 4 per cent.; and to June and December, 1890, 6 per cent. Reserve fund, £10,000. Debentures, £60,000.

Sydney and Louisburg Coal.—Accounts to December 31 submitted about May. In respect of 1889 15 per cent. was paid on the first preference, and for 1890, 10 per cent., leaving arrears of 50 per cent.

Anglo-Canadian Asbestos.—Reconstructed in 1889. Accounts to December 1st submitted in April. At general meeting held on 16th April, a dividend at the rate of 20% per annum was declared. Debentures, £3,450.

Anglo-Canadian Phosphate.—The preference shares rank first for 7 per cent., and after a like rate has been paid on the deferred shares, both classes rank equally. Accounts to November 30, submitted in May. No dividend yet on either class. Debit to profit and loss on November 30, 1890, £5,749.

Bell's Asbestos.—Accounts to December 31 submitted in January. Dividends for 1888 and 1889, 22½ per cent. each year; 1890, 15 per cent. Reserve, £45,000. The debentures are redeemable by 1913, by annual drawings at 115 from a sinking fund, which the directors may increase.

Canadian Phosphate.—Accounts to November 30 submitted in February. The working of the eleven months to November 30, 1888, resulted in a profit of £2,576, which was carried forward. A dividend of 6d. per share was paid November 1, 1891.

General Phosphate.—Registered June 13, 1890. To acquire properties in Canada and elsewhere. The founders' shares take one half the profits after providing for ten per cent. dividends on the ordinary.

Leeds Copper.—Registered January 16, 1891. To take over the properties of the Excelsior Copper Co., (Ltd). Authorized capital, £450,000. Accounts to Dec.

Nova Scotia Gold Yield.

The following returns of the quantity of quartz crushed and yield of gold from the Nova Scotia mines for the half pear ended 30th June last, has been forwarded throughthe courtesy of the Mines Department :

DISTRICT.	QUARTZ CRUSHED.		YIELD OF GOLD.		
	Tons.	Cwts.	Ozs.	Dwts.	Grs.
Sherbrooke........	253	..	69	12	..
Salmon River......	2260	..	640	10	..
Oldham	413	9	1070	18	2
Waverley	155	..	56	17	..
Moose River, Caribou	2392	19	847	12	4
Uniacke...........	1051	10	1026	18	21
Lake Catcha........	1501	..	325	8	..
Whiteburn.........	743	15	697	2	2
15 Mile Stream.....	2780	..	1445	8	..
Stormont..........	227	15	217	9	..
Tangier............	42	.	13	3	12
Renfrew...........	31	..	4	..	..
Leipsigate.........	16	..	19	10	..
Wine Harbor.......	1336	..	610	5	..
Central Rawdon.....	510	..	342	..	..
Gay's River	210	..	17	15	..
Montague..........	468	..	761	4	..
Malaga............	2916	..	2150	5	17
Killag............	154	10	154	11	16
Beaver Dam........	355	..	100	18	13
Scraggy Lake .... (Mortared Gold)	....	..	8	6	..
East Rawdon.......	340	..	60	16	15

Tandem Tanks for Hoisting Water From Flooded Slopes.*

By J. H. Bowden, Wilkes-Barre, Pa.

Water hoisting tanks have been designed for removing water from recently flooded mines, through their hoisting slopes, with rapidity proportional to the capabilities of the hoisting machinery available, the tanks being adaptable to slopes of small sectional areas and varying pitches.

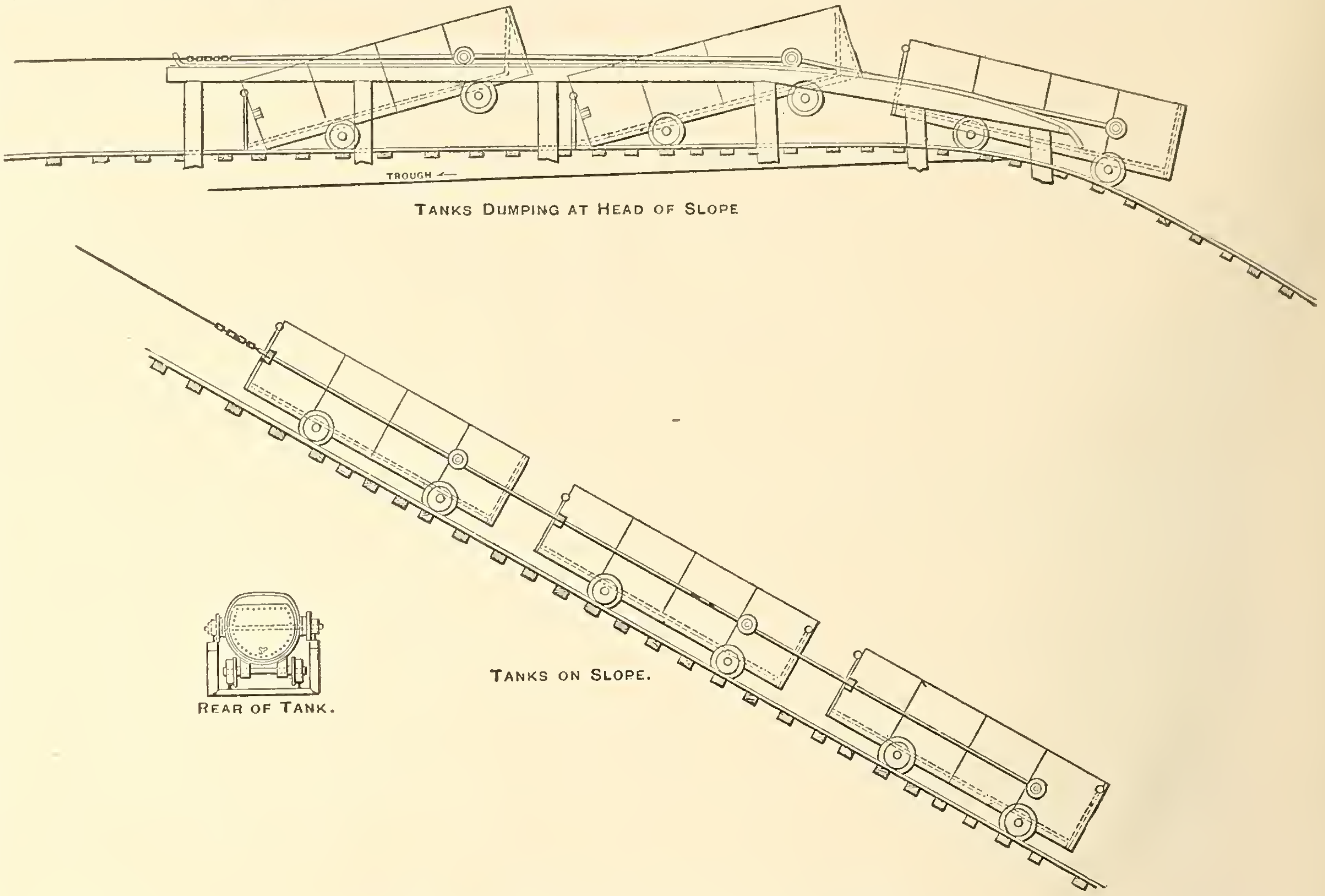
The following features may be of interest to those operating mines liable to be flooded.

1. The arrangement of doors on each tank by which it may be automatically filled by immersion at any point on the varying pitch of a slope, the water being retained while hoisting on the flat as well as on the steep pitches, and quickly and automatically discharged at the top.

2. The arrangement, in connection with the above mentioned doors, of side wheels over the rear wheels of each tank and of side dumping tracks at the top of the hoist, for the automatic emptying and quick return of the tank.

3. The arrangement of two or more tanks, one in front of the other, so as to give as large a capacity in a single hoist as the engine power will permit, yet without making any tank too large for the sectional area of the slope, or of unwieldy length, or of such a shape that it cannot easily pass over vertical curves; and without concentrating too much weight on any one pair of wheels or on any point of the track.

The details of construction and method of operating may be gathered from the following description: At the end of each tank is a large iron door of almost the full size of the end of the tank, opening inwards, so that when immersed the tanks fill almost instantly. To provide for holding the water while it is hoisted up flat pitches, a wooden door is attached to the front of each tank, opening outward. Each front door is attached to the door at the back by an iron rod, provided with a sliding link, so that the back door can open independently of the front; but the latter is held closed as long as the rear door is closed. This connecting rod, passes through the front door and through a spiral spring in front of it, so that the amount of pressure necessary to keep the water from leaking out may be readily applied. The tanks are mounted on self-oiling closed wheels, so arranged as to exclude water from the bearings while the tanks are immersed, and to retain the lubricant. Each tank is provided also with side-wheels, vertically over the rear axle, which have a guage sufficiently wide to clear all other portions of the tank; and on the surface an elevated track is provided, upon which the dumping wheels run and thus raise the rear end of each tank as much as may be necessary to dump the water into a trough between the tracks; the tilting forward of the tanks opening the back door and releasing the front one. The tanks while emptying rest on their forward wheels and on the dumping wheels. By having the tracks at the surface slightly up grade, the tanks will run back when empty, as soon as the rope is slackened. To allow this dumping, the hoisting rope is attached to the tanks by a yoke reaching back on the sides and pivoting on the axle of the dumping wheels, the tanks back of the first one being attached by eye bars reaching from axle to axle of the dumping wheels on the tanks. A stop is provided, to prevent the yoke on the forward tank from dropping and catching in the track when the rope is slackened. This plan of "tandem tanks" was designed and used to hoist about 25,000,000 gallons of water which had been admitted to extinguish a mine fire in one of the Susquehanna Coal Company's mines. The slope was small in section, and 3,200 feet long, with single track, and with pitches varying from 4 to 20 degrees. The hoisting plant consisted of a pair of 26 inches by 60 inches direct acting engines with cast coned drum, 9 to 12 feet in diameter, carrying $1\frac{3}{8}$ inch steel rope. These engines had been previously hoisting five cars, weighing about 4 tons each when loaded.



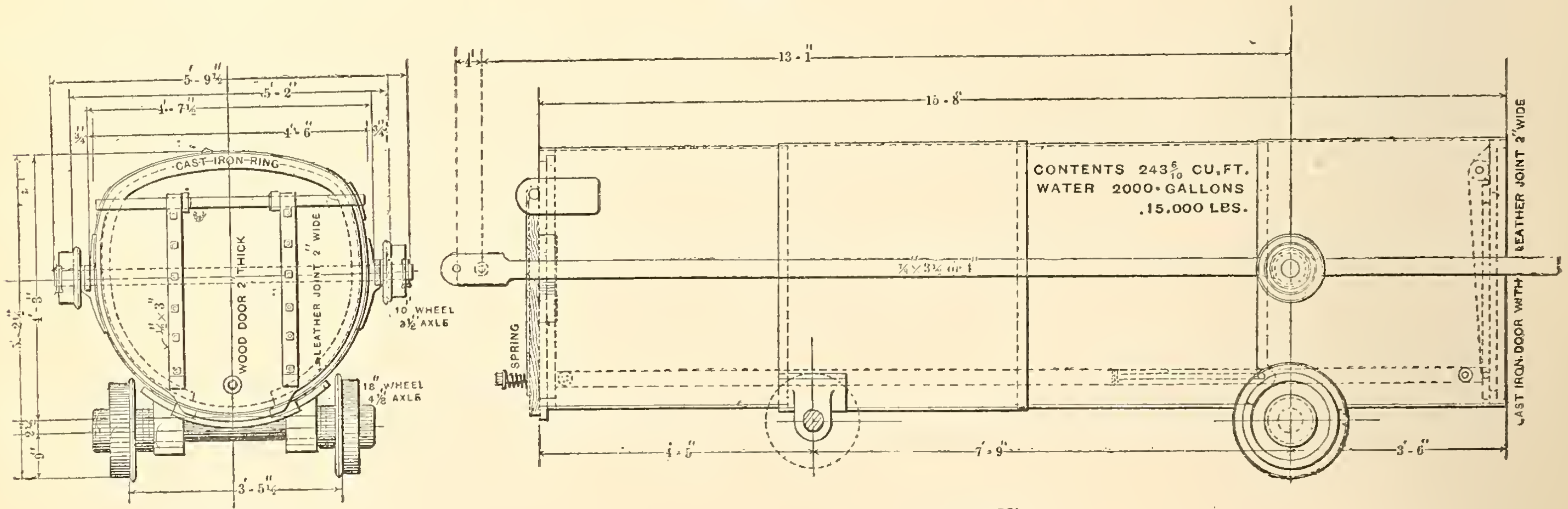
Tanks Dumping at Head of Slope

Rear of Tank.

Tanks on Slope.

Fig. 1.—Self-Loading and Self-Dumping Water-Tanks.

Fig. 2.



Front End.

Side View.

Self-Loading and Self-Dumping Water-Tanks.

Profit Sharing in the Iron Trade.—Sir Alfred Hickman, proprietor of the Spring Vale Furnaces, Woverhampton, who is the largest pig iron maker in South Staffordshire, has issued a circular to his workmen, stating that he proposes to give them a direct interest in their labor by granting each man a substantial bonus out of the profits of his trade during the year ending next June. As soon as the result of the year's working is ascertained he will divide among them a certain share on their earnings. He wishes them to understand that they are not partners, and he reserves to himself the right to deal with them as to retaining their services or otherwise. An iron foundry at Gross-Ilsede, Hanover, employing from 600 to 700 men, has carried on the system of profit-sharing since 1869. All the employed who have deposits in the factory savings bank are participators in it. If the net profits of the firm exceed 5 per cent., a corresponding addition, up to 15 per cent., is made to the 5 per cent. interest given on the savings bank deposits. Hence, those deposits can bear up to 20 per cent. interest. The following table shows the percentage paid from 1869 to 1883: 1869, 8 per cent.; 1870, 9 per cent.; 1871, 10 per cent.; 1872, 18 per cent.; 1873-74, 20 per cent.; 1875, $6\frac{2}{3}$ per cent.; 1876, 6 per cent.; 1877, $6\frac{2}{3}$ per cent.; 1878-79, 10 per cent.; 1880-83, 20 per cent. In the year 1883 the number of depositors was 566, and the total savings amounted to £25,850, a proof that the system had a strong influence on the thrift of the people employed. The factory also has a "workmen's bank," which any of the men may join. It is supported by contributions equal to 6 per cent. of the wages, half of which are paid by the men and half by the firm. The accumulated capital of this bank amounted in 1883 to £15,000. There are also two widows' and orphans' funds—one for the lower class of workmen, and one for the foremen and employés.—*Colliery Guardian.*

◆

Great Coal Hoisting in Pennsylvania.—At the Nottingham Colliery, Plymouth, operated by the Lehigh & Wilkes-Barre Coal Co., 1,313 cars were hoisted in nine hours the other day. At No. 11 colliery, owned by the same company, 693 were hoisted on the same occasion.

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* Read at the Glen Summit meeting of the American Institute of Mining Engineers, October, 1891.

INDUSTRIAL.

The Dodge Wood Split Pulley Company call attention to their advertisement in another place. Their system of rope transmission of power is one that has found much favor at a number of our mines and collieries, and well deserves the attention of such of our engineers as may be figuring on new power plants.

A most severe and very interesting test was made last week by Wm. Sellers & Co., of Philadelphia, upon a motor operated under the new principle invented by Mr. H. Ward Leonard. The motor used was a 10 H.P. standard shunt-wound Sprague motor. The motor's normal speed was 1,500 revolutions a minute. The motor was belted to a countershaft, and upon the countershaft was placed a brake, and in addition to the hrake there was placed upon the countershaft a large fly-wheel such as is used upon punching machines, the purpose of the fly-wheel being to duplicate the inertia and momentum met with in practice in a great many kinds of work.

The motor was made to operate in either direction at any rate of speed desired, and it was found possible to run the motor perfectly and regularly under the full brake load at 15 revolutions per minute, that is, one per cent. of its full speed. While operating at full speed in one direction, the motor could be instantly reversed, the reversal being perfectly gradual and entirely without any spark or troublesome feature of any kind.

In order to get the most marked effect in overcoming the momentum of the fly-wheel the brake was taken off, and when the fly-wheel was running at its full speed of 300 revolutions a minute, the motor was reversed instantly. In thirteen seconds the motor had brought the fly-wheel to rest, and in thirteen seconds more had it running at full speed in the opposite direction, the entire operation being effected with the greatest smoothness and without any spark whatever.

The performance of the motor was extremely satisfactory to all concerned, and showed its perfect adaptability to any class of work to be met with in practice.

The Ingersoll Rock Drill Company of Canada has just closed a contract to put in several of their Sergeant coal cutters and other mining machineiy in Cape Breton collieries. Mr. George R. Smith, who has just returned from the Pacific coast, reports that the company has also done well there, having made some good contracts with the collieries and mines.

The Jeffrey Manufacturing Company, Columbus, Ohio, reports business as good in their different lines of specialties. They have many large orders on their books for elevators and conveyors for handling material in bulk or package, and have recently purchased a tract of land adjoining their present extensive works, on which they have erected a large substantial brick building, that they may be better able to take care of their growing business.

◆

Quarrying and Splitting Slate.

In quarrying slate, the methods vary greatly according to the disposition of the beds, and no attempt will be made here at a detailed description. Ordinary blasting powder is employed in loosening the blocks, and great skill and sagacity is shown by experienced quarrymen in so manipulating the blasts as to produce the desired effects of freeing the rock from the quarry bed without shattering the stone. After a block is removed from the quarry it is subject to special treatment, according to the purpose to which the stone is to be put. If for roofing slate, the block is taken from the quarry to the splitters' shanty, where it is taken in charge by a splitter and his two assistants. The first assistant takes the block and reduces it to pieces about 2 inches in thickness, and of a length and breadth a little greater than those of the slates to be made. This is done by a process called "sculping," which is as follows: A notch is cut in one end of the block with the sculping chisel, and the edge of this notch is trimmed out with a gouge to a smooth groove' extending across the end of the block and perpendicular to the upper and lower surfaces; the sculping chisel is then set into this groove and driven with a mallet until a cleft starts, which by careful manipulation is guided directly across the block. The upper surface of the block is kept wet with water so that the crack may be more readily seen. If the slate is perfectly uniform in shape and texture, and the blows upon the sculping chisel are directed straight with the grain, the crack follows the grain in a straight line across the block. Almost invariably, however, the crack deviates to the right or left, when it must be brought back by directing the blow on the sculp in the direction in which it is desired to turn the break or by striking with a heavy mallet on that side of the block toward which it is desired the crack shall turn. Some slates can be sculped across the grain, but nearly all must be broken in this direction. From the first assistant or "sculper," the block goes to the splitter, who, by means of a mallet and broad thin chisel, splits it through the middle, continuing to thus divide each piece into halves until the desired thinness is obtained. It is necessary to keep the edges of the blocks moist from the time they are removed from the quarry until they are split. From the splitter, the thin but irregular shaped pieces pass to the second assistant, who trims them into definite sizes and rectangular shapes. This is done either by hand or by machine. To trim by hand a straight-edged strip of iron or steel is fastened horizontally upon one of the upper edges of a rectangular block of wood, some 2 to 4 feet in length. The trimmer then lays the sheet of slate upon the block, allowing the edge to be trimmed to project over this strip, and then by means of a long heavy knife with a hent handle, cuts off the overlying edge, thus reducing it to the required size and shape. Two kinds of machines for doing this work are now in use. In general they may be said to consist of an iron frame work some 2½ feet high, with a horizontal knife edge upon its upper edge. Against this knife is made to work, by means of a treadle, another knife, curved in outline, which is thrown upward again by means of a spring, after being brought down by the treadle-movement. At right angles to this knife edge, on one side of the machine, an iron arm projects toward the workman; this arm has notches cut into it for the different sizes of the slate. The difference between the two kinds of machines is said to consist chiefly in the arrangement of the cutting knife, one working as stated above, while the other revolves on an axle something in the manner of an ordinary corn cutter. Slates are sawn by means of an ordinary circular saw, such as is used in sawing lumber, and are planed by machines such as are used in planing metals, as are other soft stone. Some of the hard slates used for tiling have to be cut by means of circular saws with teeth of black diamond. In trimming out school slates at the Pennsylvania quarries, there is used a square saw of chilled iron, someten or twelve inches in diameter, and with one long projecting tooth at each of its four corners. This revolves with great rapidity and clips off the thin edges as quickly and neatly as could be desired.

◆

The Pressure of Gas in Coal.

Coal in bituminous mine seams is more or less subjected to bleeding. This is known to the practical miner; he is constantly observing the sweating of the coal, accompanied with a hissing sound. The sweating is produced by the pressure of gas stored up in minute cavities and fissures of the seams. The pressure has been found in some cases to be nearly equal to the pressure of steam in the boilers of steamships. Pressures of 200 pounds and upward have been found to be common in deep seams newly opened. What is interesting about the matter is the co-relationship of the pressure of gas to the pressure due to a vertical column of water, measured from the seam to the drainage level of the rocks overlying the seam. To make this clear, let us suppose a seam to be 250 fathoms from the surface; again, let us suppose the drainage level is about 50 fathoms from the surface. Now by these data we may, with considerable accuracy, calculate the pressure of gas stored up in the cavities of the seam. Suppose the seam has not been wrought, but has been pierced by a bore hole. If a long iron tube was inserted in this bore hole and made to fit the hole so closely by some system of packing that no gas could escape, and a pressure gauge was screwed on the upper end of this pipe and allowed time for gas to accumulate in the bore hole, the pressure ultimately observed might be calculated as follows: Vertical height of water being 200 fathoms, then—

$$\frac{200 \times 6 \times 62{\cdot}5}{144} = 520 \text{ pounds pressure on the square inch.}$$

This calculation may be made by a simpler process: a square inch column of water having a vertical length or rise of 6 feet weighs nearly 2·6 pounds, therefore $200 \times 2{\cdot}6 = 520$, or is equal to a pressure of 520 pounds on the square inch, as before. Often, at faults and dislocations, water and gas are met with in unusual quantities. Sometimes on cutting a fault, gas is given off, generally at the bottom of the seam, and this often conststs of sulphureted hydrogen. Water generally comes off at the fault at the top of the seam, and after it has expended itself, it is followed by gas. Now, why gas should be found at the bottom of the seam and water at the top, is a matter full of interest. Water is sometimes given off at the bottom of the seam, and when that is the case, the reason why requires observation and investigation. Some cavity in the neighborhood of the fault contains gas at a high pressure, but is situated above another cavity filled with water, so that while the gas is pressing on the water, water flows from the bottom of the seam, through some vent or parting in the fault, but as water is heavier than gas, if the water and gas are found in one cavity in the bottom stratum of rock communicating with the fault or fissure, then gas only is given off, and sometimes at a high pressure. But it will be noticed that after a while the gas is all spent off, and the air in the neighborhood of the fault resumes its normal condition. The gas is expelled by the operation of Boyle's law; it exists in this bottom cavity at a pressure considerably above that of the atmosphere and if the pressure of the gas in the cavity was three times that of the atmosphere, on that pressure being removed it would expand into three times its original volume, or every cubic foot in the cavity would expand into three cubic feet, two of which would be expelled. When water is given off at a fault at the top of the seam, we may certainly expect it to be followed by gas, because, being lighter than water, it is pent up at a high pressure above it, and the high pressure of the gas causes a rapid or violent outflow of water. Now as gas cannot sink in water, if the bottom of the cavity communicates with the fault, then no gas will spend off until the water has all been expelled.

◆

A Rope Four Miles Long.—A single rope, 4 miles long, and weighing 20 tons, has been turned out at the ropery of Messrs. Webster and Sons, Deptford, Sunderland. It is made of the best steel wire, and is intended for a colliery in the south-west of England, where it will be used for underground haulage. As the cranes at the rope yard and at the goods station are not strong enough to lift such a load all at once, the rope was made up into three coils, and, allowing the slack connecting these to hang, they could be lifted one at a time. Two were put on one rolley, a very strong one, and the third coil, which contained much less rope than the other two, was put on to an ordinary rolley. Several men carried the slack which hung from one vehicle to the other over their shoulders. The load was drawn by 20 horses, and the passage through the streets attracted much attention.

◆

The World's Horse Power.—It is stated in *Handel's Museum* that the steam power of the world is equal to the strength of 1,000 millions of men, or twice the number of working men that exists. The horse power of England as regards engines, is estimated at 7,000,000, of the United States 7,500,000, Germany, 4,500,000, France 3,000,000, and Austria 1,500,000. These figures do not include the horse power of locomotive engines, of which it is estimated that last year there were in the whole of the world 105,000, representing horse power from 5,500,000 to 7,000,000. From further calculation it is considered that the total horse power of the world's engines is about 49,000,000, the average strength of each engine being equal to three horses, the power of the horse being equivalent to the strength of seven men. The steam engine, there is no question, has been of the greatest possible advantage to the working classes all over the world, for it has lessened their labor by doing the heaviest portion of the work, and so saving their strength. Yet machinery for economising human labor even now is strongly opposed by those who would be most benefited by it.

◆

A Heavy Coal Train.—It is reported that last Sunday locomotive 955 on the Philadelphia and Reading Railway hauled a train of ninety 25 ton cars loaded with coal, from Palo Alto to Port Richmond. These cars were all about 34 feet in length, thus making the total length of the train about 3,100 feet, or considerably more than half a mile. The total weight of the train was estimated at 2,375 tons. The weight of the engine was about 75 tons. If this report is true the train hauled was probably the longest and heaviest that was ever taken over that road.

◆

A Novel System of Coal Hoisting.—The Southwest Coal and Coke Company will introduce a novel system of coal hoisting when it gets the new air shaft at its Tarr's plant completed, as that work will be done by water. The big fan and part of the machinery are already in place awaiting the erection of the house and the sinking of the shaft which, at this point, will reach the coal at a depth of some twenty-five feet, although it is the basin for a goodly portion of the company's 2,500 acre coal field, and from it the drainage will be pumped. One of the cages will not differ from those in general use, while the other will have built on it a tank. When a waggon of coal for the boilers has been placed on the cage at the bottom, water from a pump discharge pipe will be turned into the tank until it is heavy enough to sink to the bottom, drawing the cage up as it descends. An automatic valve will then let the water run out, when the tank, being lighter than the cage and empty waggon, is in turn drawn to the mouth by them.—*Connellville Courier.*

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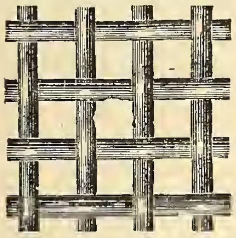

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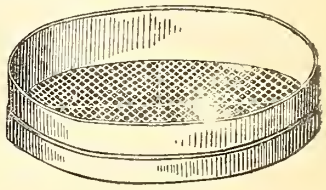

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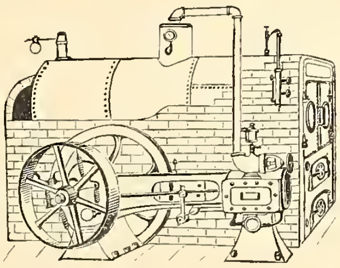

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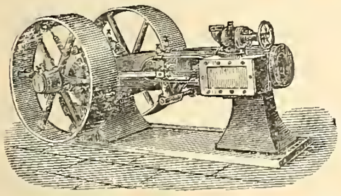

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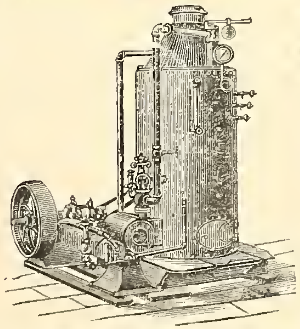

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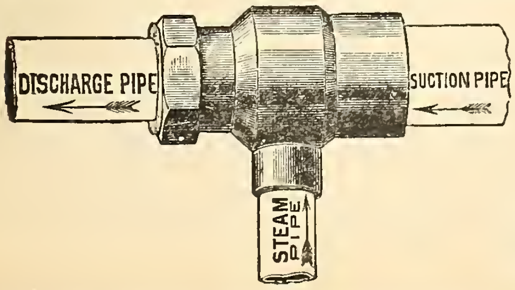

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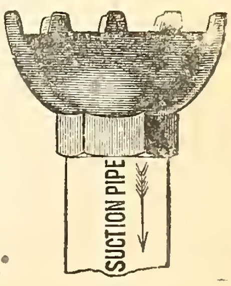

THE CANADIAN MINING MANUAL, 1892.

SECOND YEAR OF PUBLICATION.

IN PREPARATION. READY 1st JANUARY.

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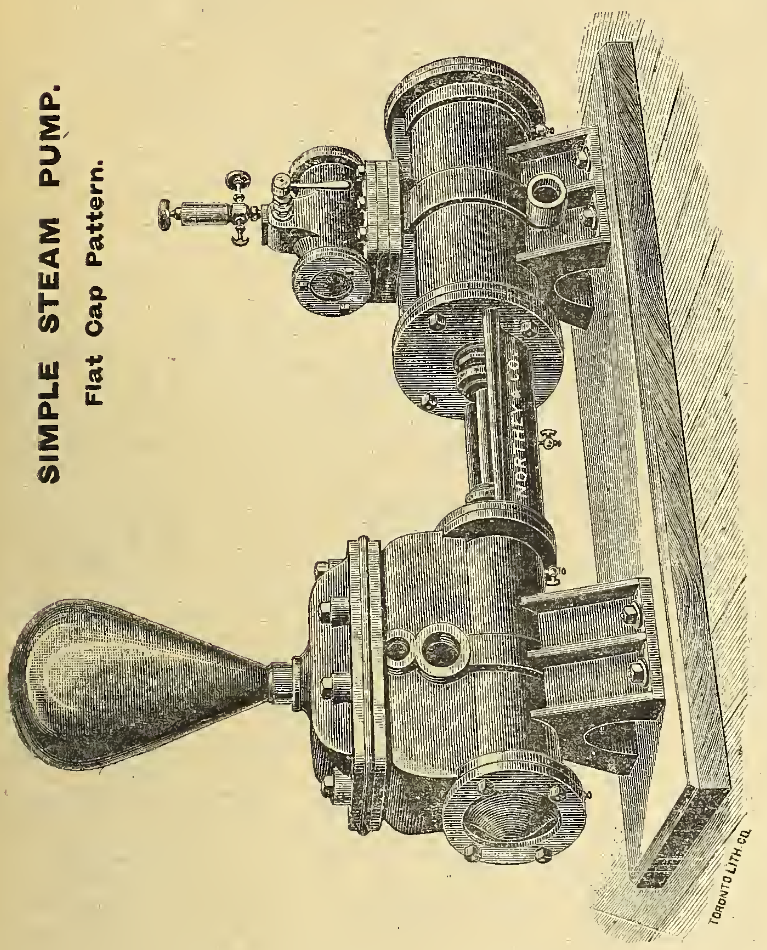
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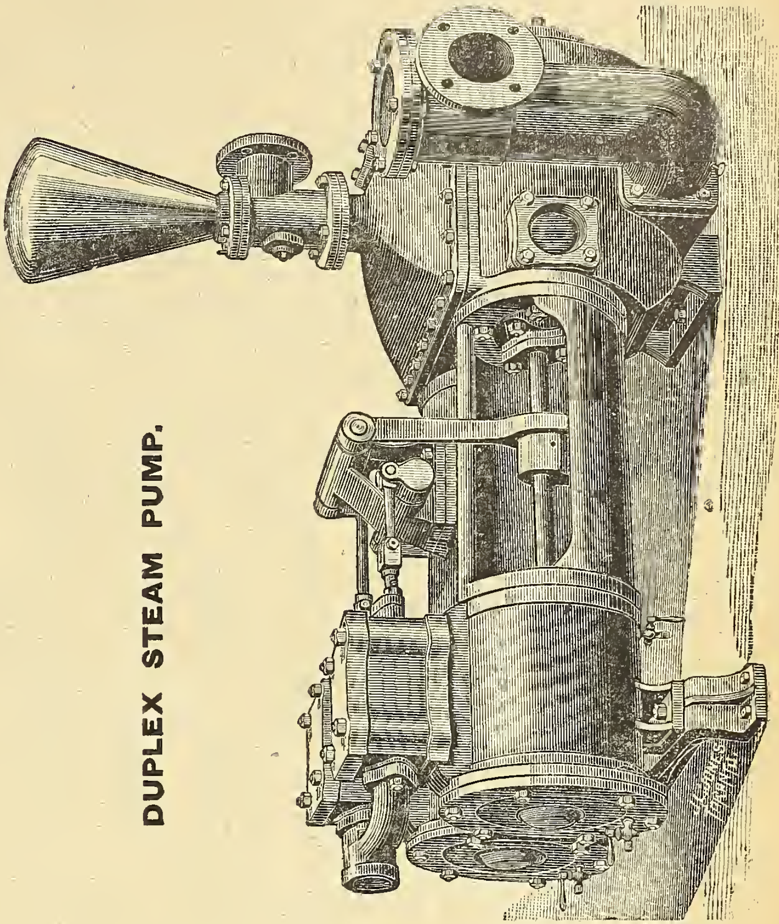

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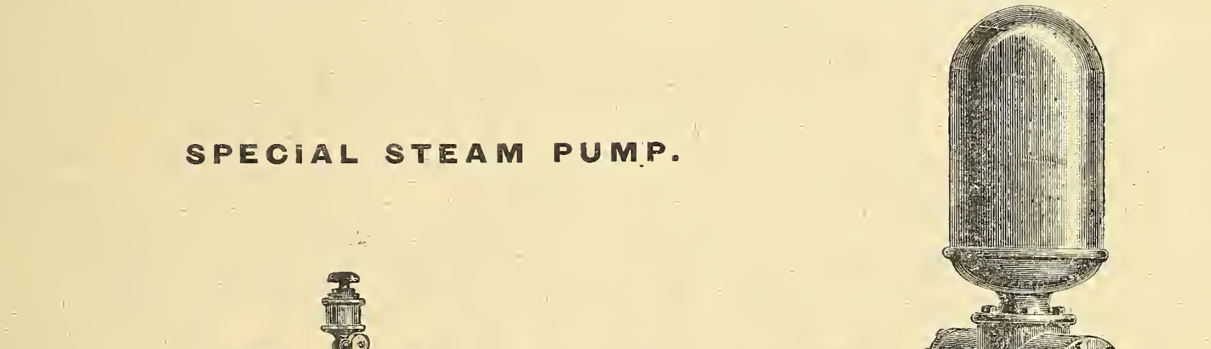

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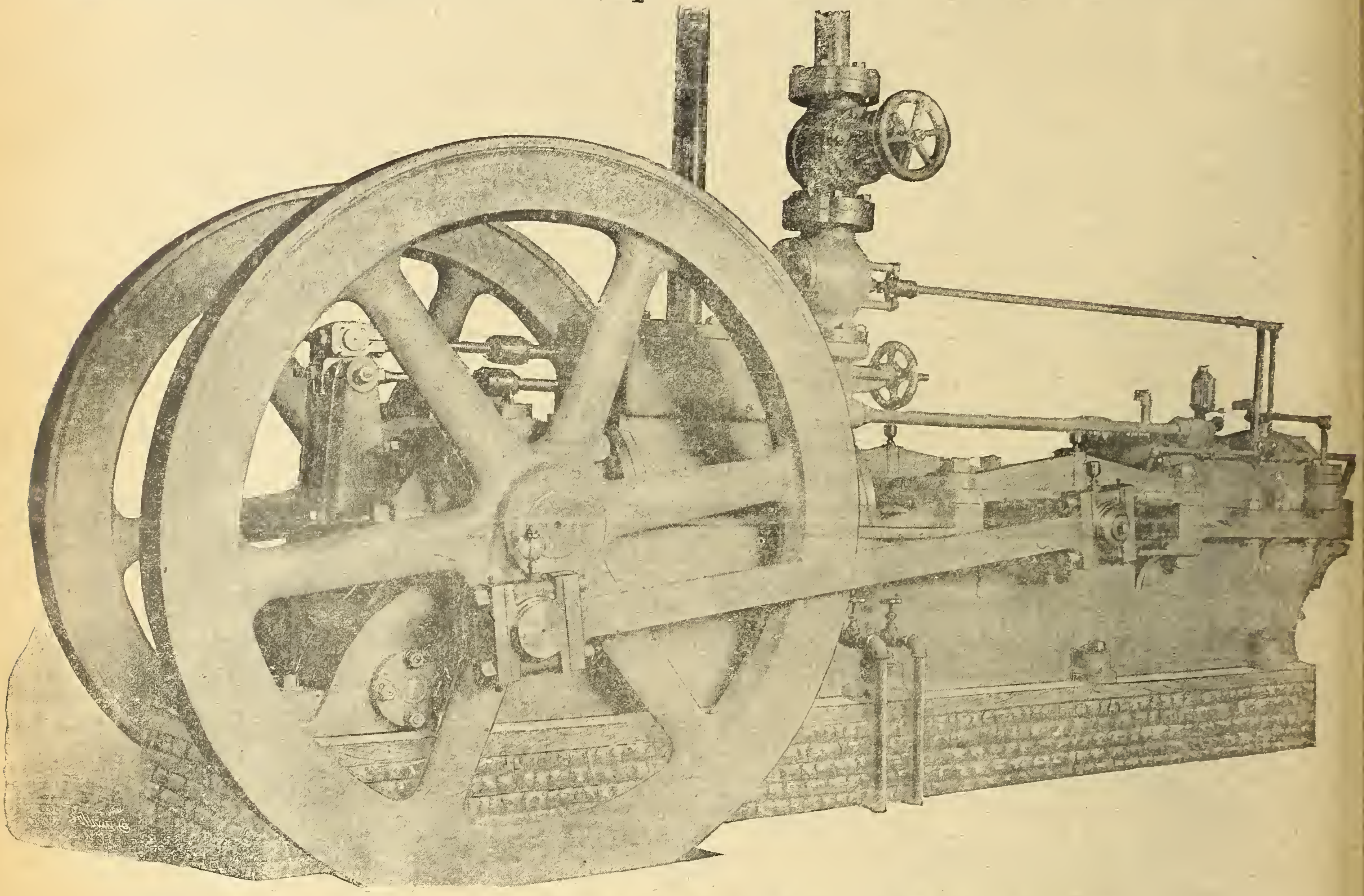

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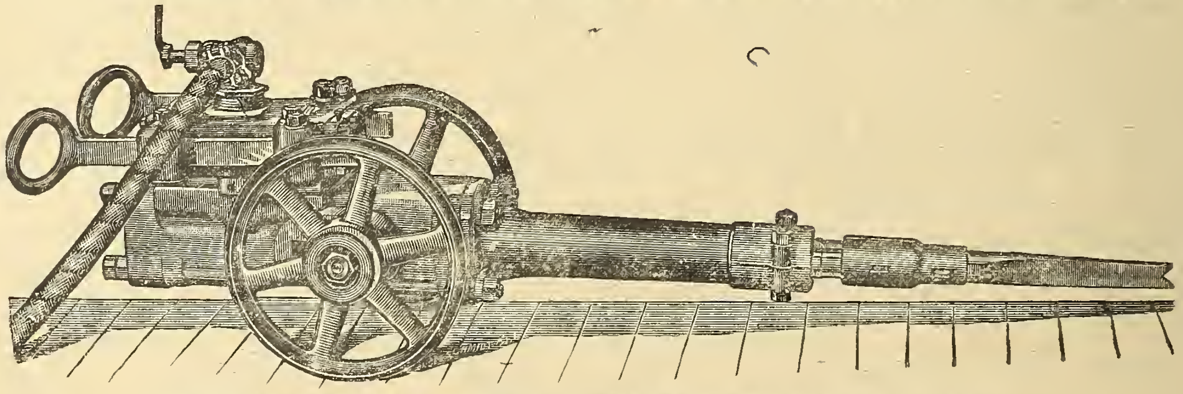

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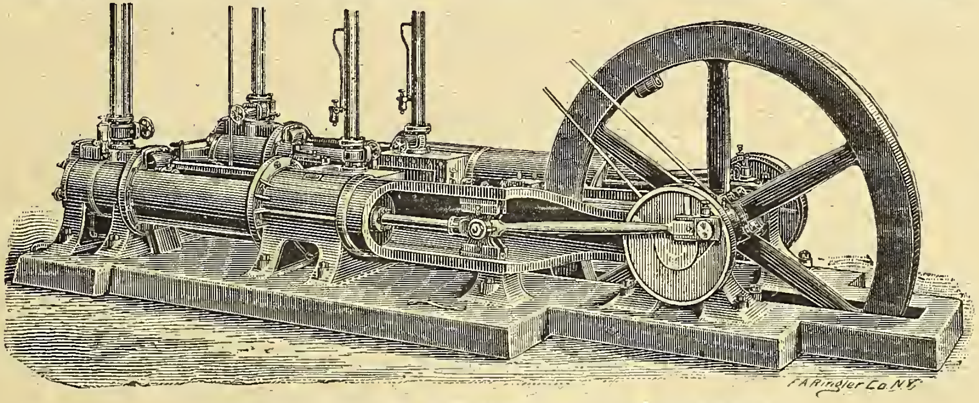

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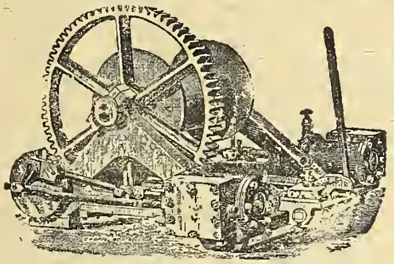

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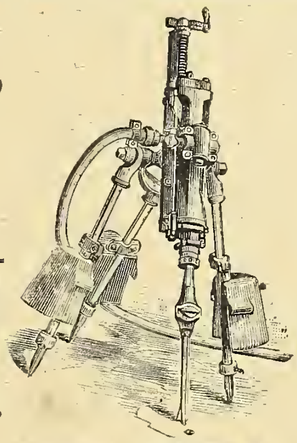

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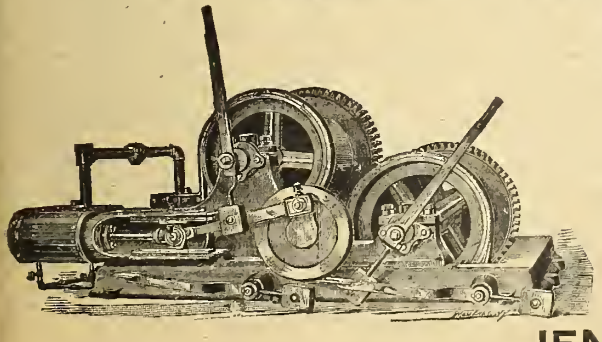

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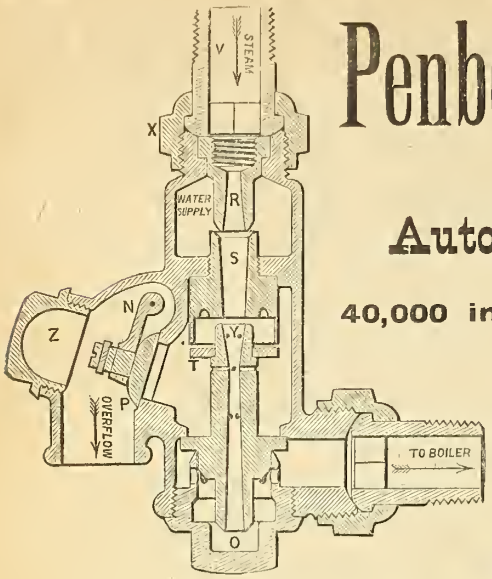

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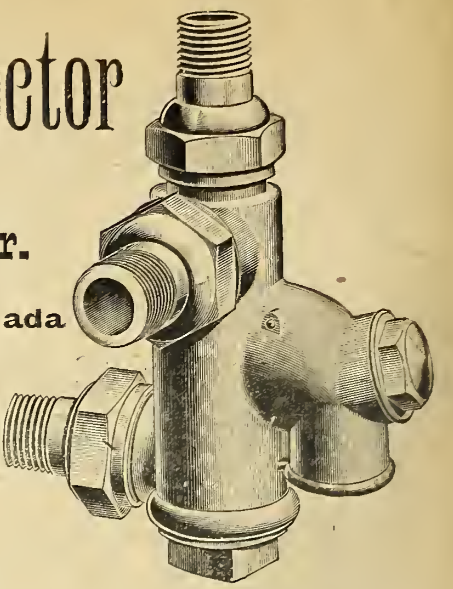

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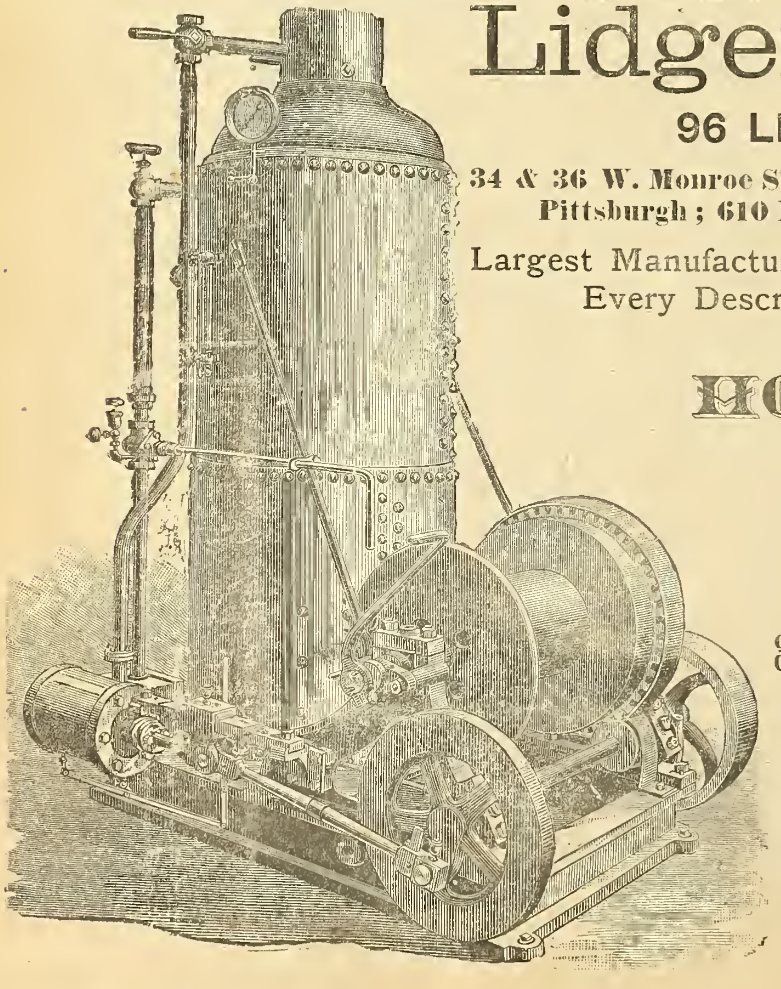

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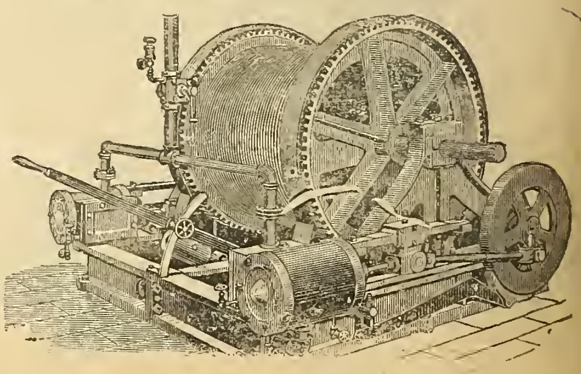

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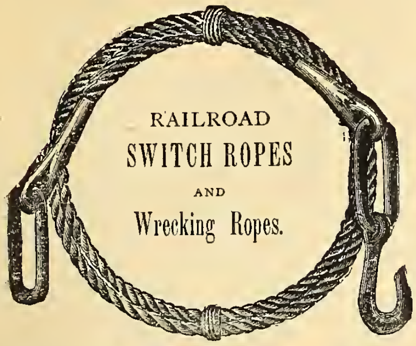

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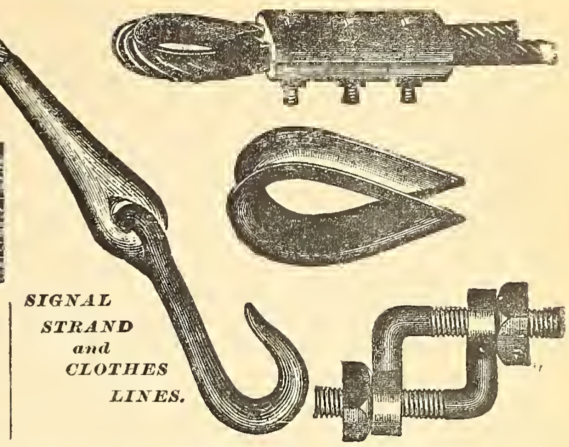

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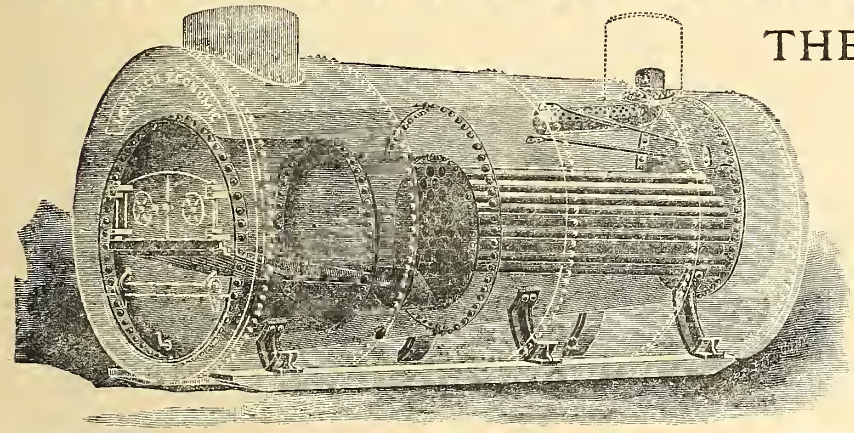

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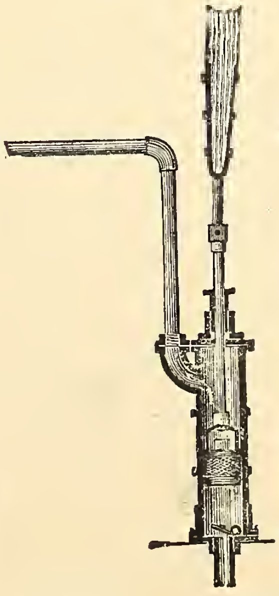

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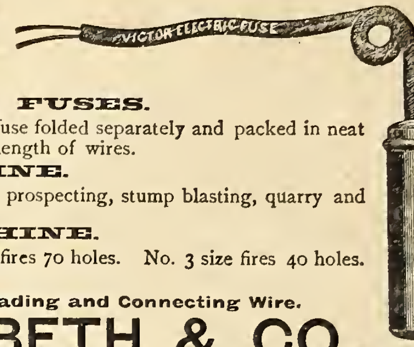

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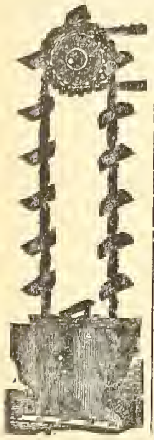

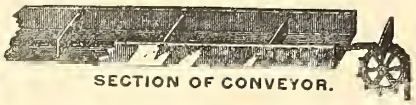

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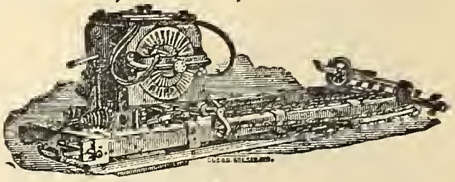

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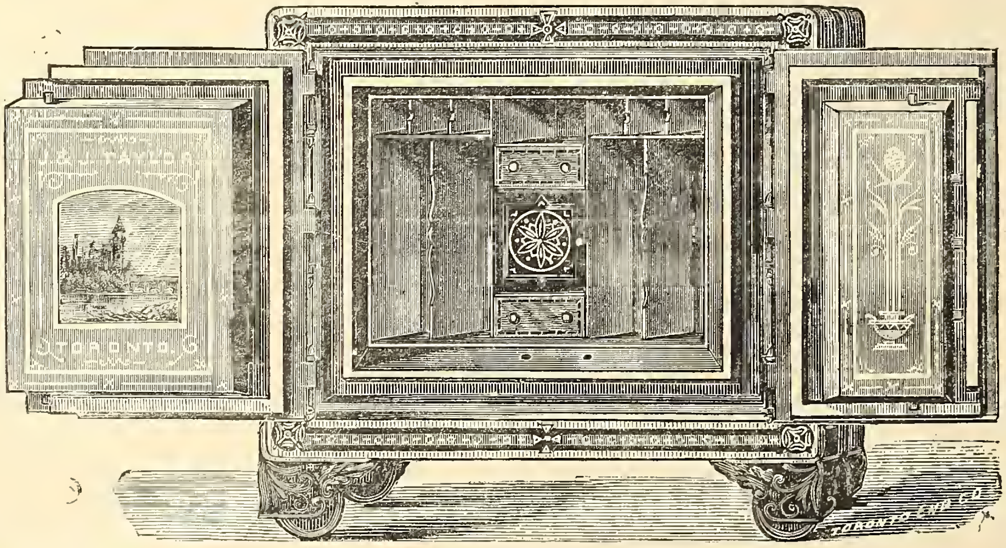

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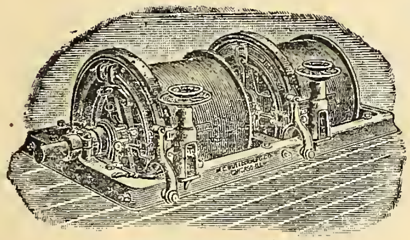

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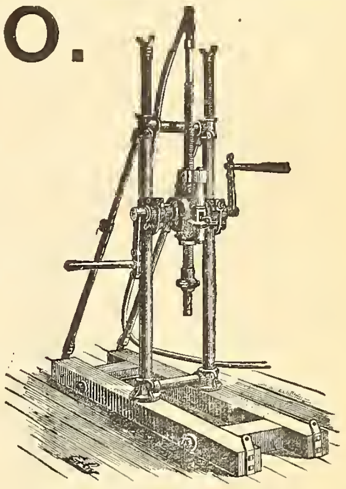

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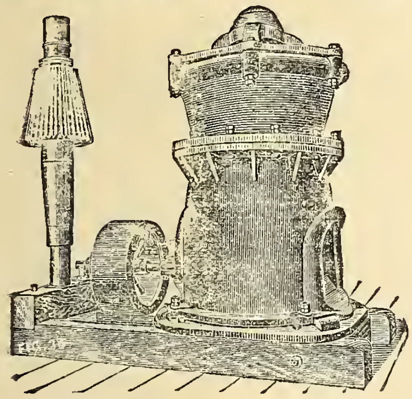

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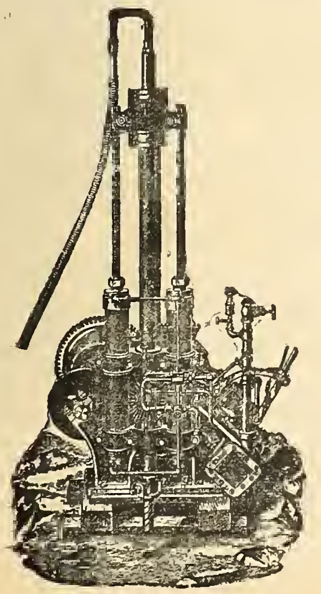

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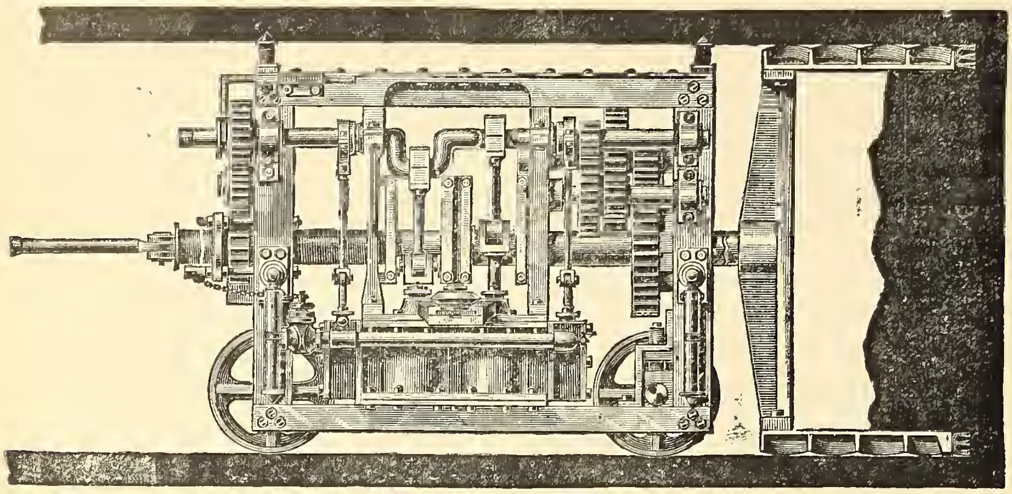

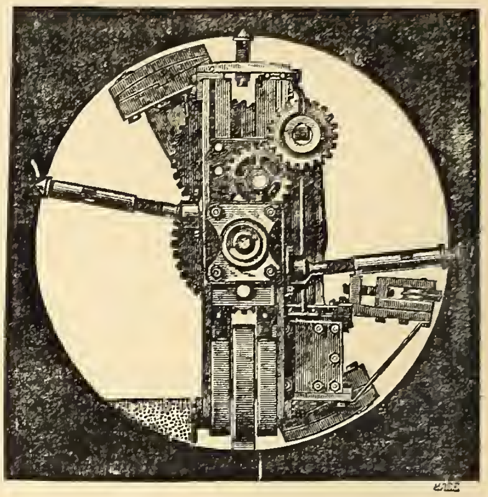

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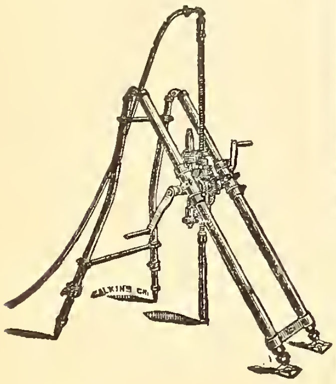

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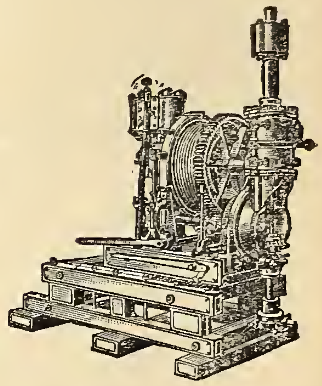

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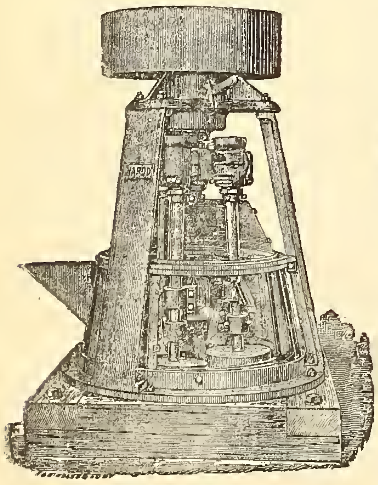

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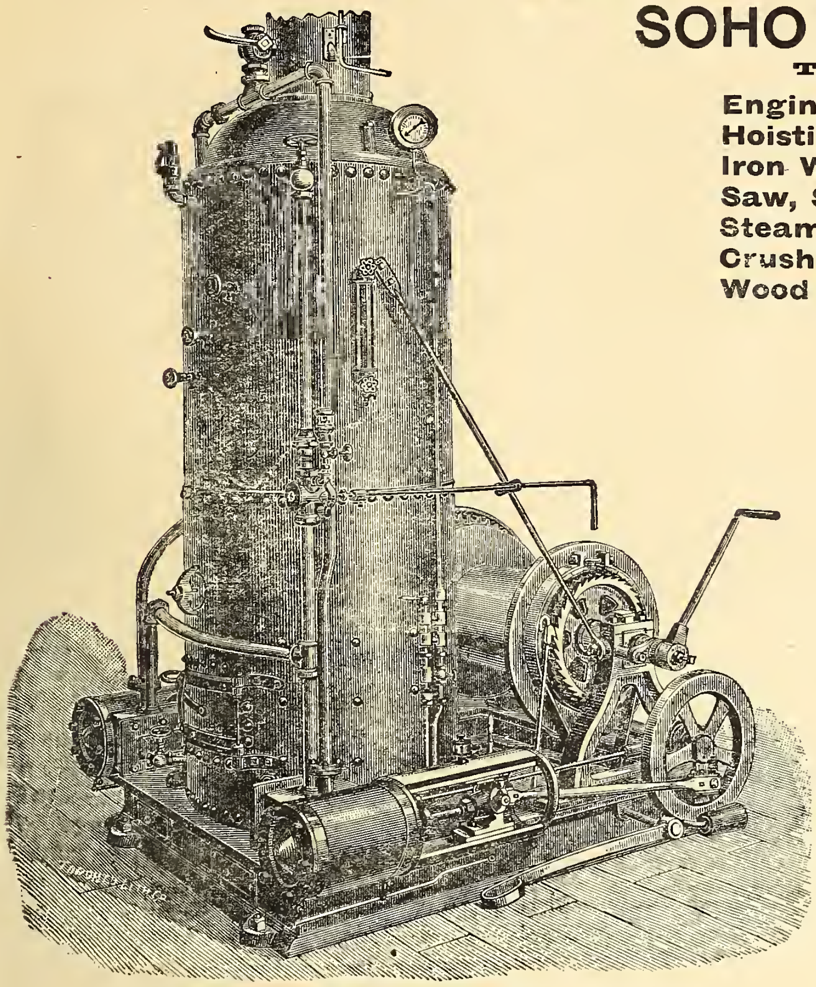

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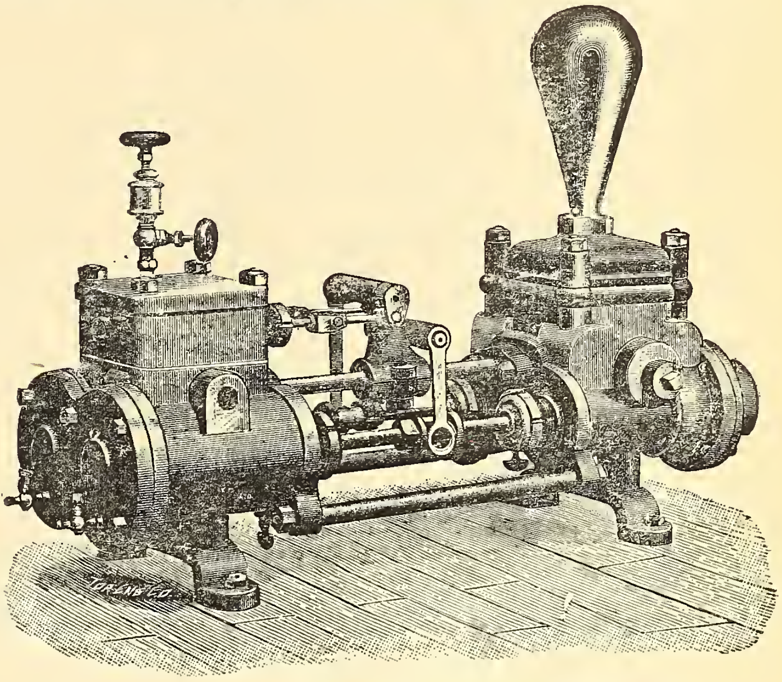

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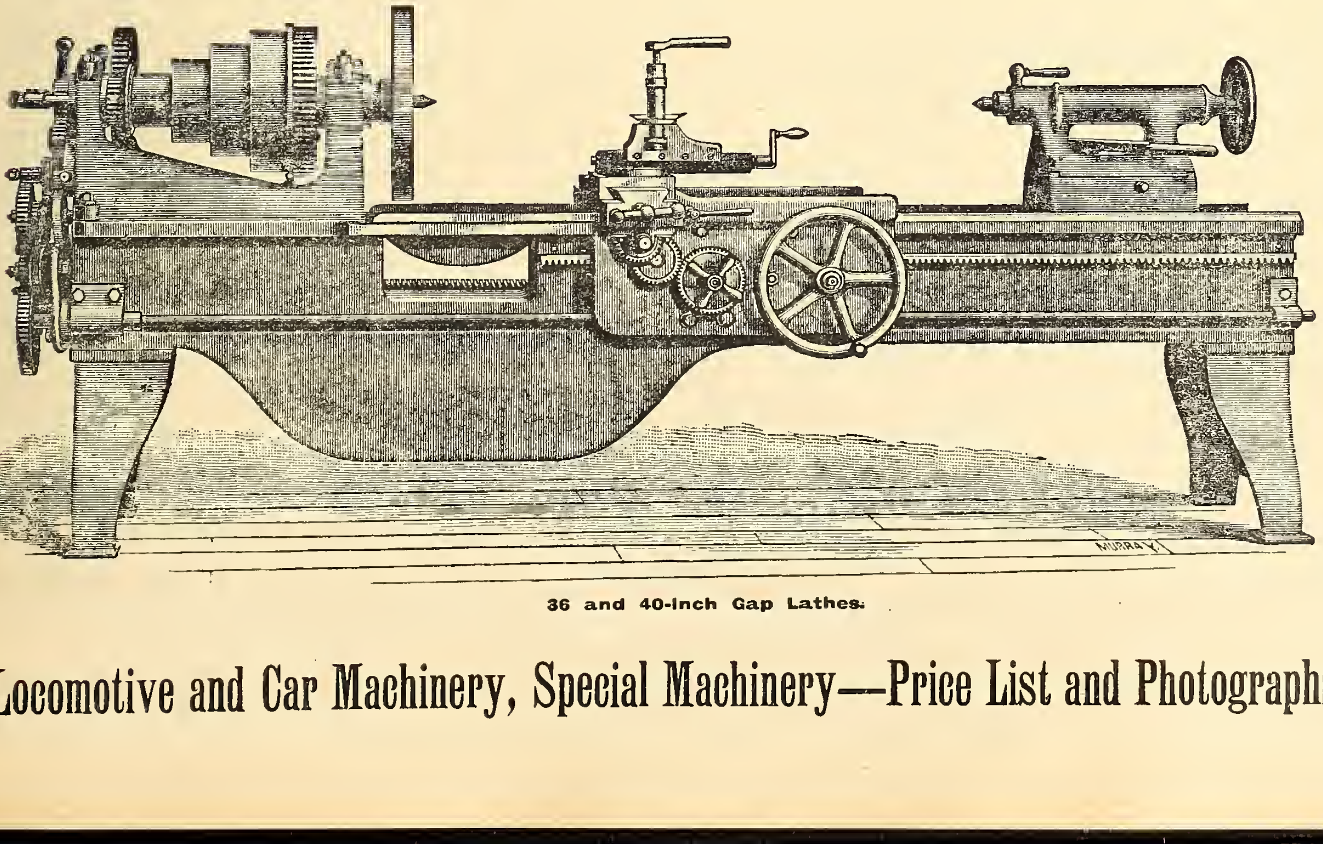

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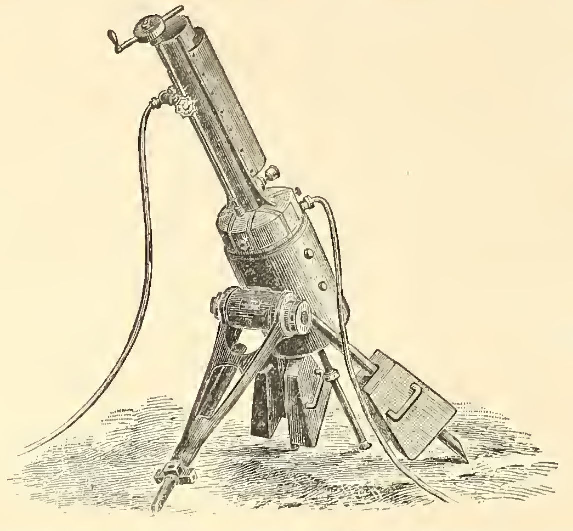

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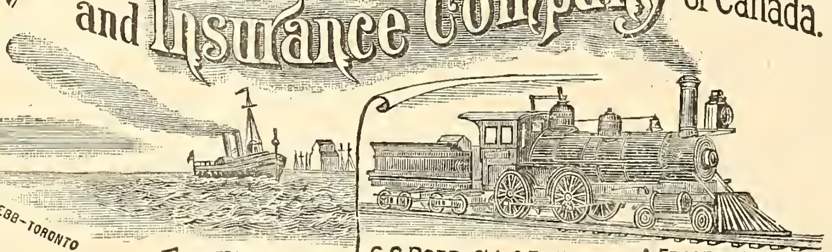

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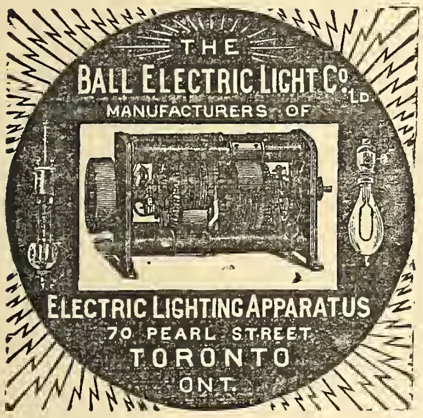

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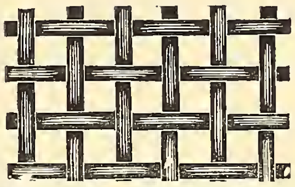

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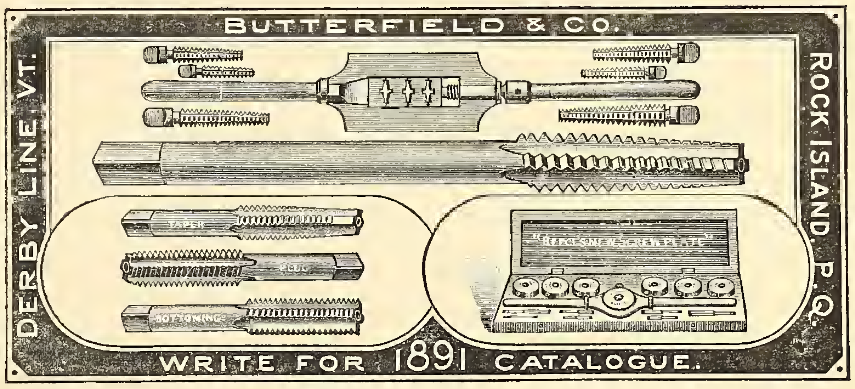
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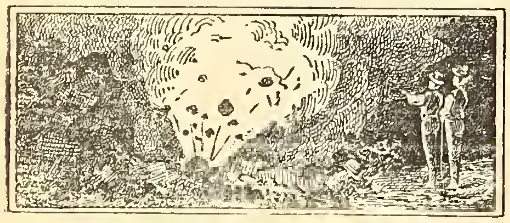

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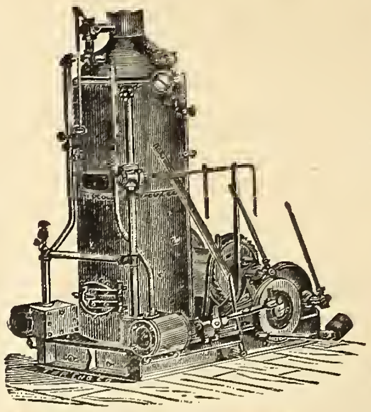

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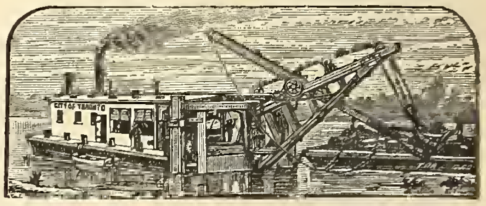

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The Phosphates of America.

A work which is of great interest and information to the miners and agriculturists of Canada, has just been issued by the Scientific Publishing Company, New York, entitled "The Phosphates of America; where and how they occur; how they are mined; and what they cost: With Practical Treatises on the manufacture of Sulphuric Acid, Acid Phosphate, Phosphoric Acid, and Concentrated Superphosphates, and selected methods of Chemical Analysis," by Francis Wyatt, Ph.D. The book is profusely illustrated, is elegantly printed upon the best of thick paper, and physically speaking is one of the weightiest books for its size that we have ever handled. The price is $4.

Every person interested in the production or use of phosphate will desire to peruse this comprehensive compilation of facts, and in the technical parts of the book many useful hints and suggestions will doubtless be of service to manufacturers and amateur chemists. The only general treatise upon phosphates published in America previous to the issue of this work was Bulletin No. 46 of the United States Geological Survey, entitled "The Nature and Origin of Deposits of Phosphate of Lime," by R. A. F. Penrose, jr., Ph.D., with an introduction by Prof. N. S. Shaler. Dr. Penrose, who became very favorably known in Canada by his connection for two years with our phosphate industry, wrote this essay of 100 pages as his thesis for the degree of Ph.D. It was published in 1888, and contains a graphic and accurate summary of all the known sources for the supply of phosphate that had up to that time received attention commercially. Since then the opening up of the Florida phosphate deposits has created a subject of interest which has literally become of overwhelming importance, as mainly owing to their competition the Canadian mines are for the moment in an embarrassed position and the prices of phosphate have been forced down to an unremunerative point for any but the most prolific and favorably situated properties. Many pamphlets have appeared describing the Florida phosphate fields, one of which, by Mr. C. C. Hoyer Millar, of London, was of interest and value; but there was a general desire for a scientific and impartial account by a skilled observer; and this need the work of Dr. Wyatt appears to have supplied.

After a general introductory account of the nature and use of phosphate, with some speculations upon its origin, the book gives a detailed description successively of the phosphate deposits of Canada, Carolina and Florida, with some account of the various mining operations, all illustrated by very instructive photographic views. These themes occupy 83 pages of the book, and the remaining 95 pages are devoted to chemical and mechanical topics relating to phosphates, such as the manufacture of sulphuric acid, superphosphates and phosphoric acid, and the description of machinery for grinding phosphates. Various formulæ for chemical analysis are given, with an elaborate list of the articles required for the outfit of laboratories connected with phosphate mines and fertilizer factories. A copious index completes the book and renders easy access to its treasures.

The portions of the book which are of special interest to Canadian readers are those which treat of the phosphate deposits of Canada and Florida. The deposits of Carolina have long been known, and, being so much lower in grade than the Canadian deposits, do not excite so much concern from a commercial standpoint. As to the Canadian deposits, it is interesting to know the impressions and opinions of so skilled and intelligent an observer as Dr. Wyatt, although the necessary limitations of his occasional professional visits to Canada for the purpose of reporting upon special properties prevent the thorough acqnaintance with the practical side of the subject only to be attained through residence and intimate connection with the operations. But the absorbing topic of interest is that of Florida phosphates, and every Canadian phosphate miner to-day is anxiously asking: Are the Florida deposits large and permanent? Are they of high grade? Are they suitable in every way for manufacture? Are they easily and economically obtained? Are they likely to crowd Canadian phosphates entirely out of the world's markets? These important questions are fully considered by Dr. Wyatt, and he justly gives the largest space and fullest treatment to this latest comer into the field of phosphate production. A few of Dr. Wyatt's valuable opinions and descriptions may be given here to intimate to our readers the nature of his conclusions and the importance of his work.

In the introductory chapter a very concise and interesting geological sketch is given as to the processes by which the earth has developed to its present condition, with some account of the formation of soils and the growth of plants. Tables of food products and their mineral constituents also convey important information. It is stated that the quantity of phosphoric acid yearly removed from the soil in the United States by the cereal crops is 2,714,585,473 lbs., equal to 19 lbs. per acre cultivated, while the hay crop removes in addition, 468,795,600 lbs., or 12·5 lbs. per acre. To supply this loss the application of mineral phosphate to the soil is clearly a necessity, and the author gives some important testimony in favor of the opinion that some phosphates on certain soils "are extremely valuable in the raw state, if very finely ground, as a direct manure." He regards the effect of the sulphuric acid upon the raw phosphate, in converting it into superphosphate, to be a subdivision of particles, and any mechanical means of securing equal fineness of pulverization would attain the same end. He also says that "superphosphates are only soluble in water so long as the sulphuric acid with which they have been manufactured retains its ascendency, and that when they reach the soil, especially where carbonates are in abundance, the sulphuric acid is at once overpowered, and the phosphoric acid, instead of remaining combined with one molecule of lime and two molecules of water, at once undergoes reversion." He states that the effectiveness of raw phosphates depends upon the activity of the soil, The farmer should apply it as finely ground as possible. "If his land be tolerably acid he will get a rapid return; but if it be not, the phosphate will not decompose, and he will have to wait perhaps several years before obtaining any appreciable results for his "outlay."

A word of comfort is given to the phosphate miner who at present is depressed by the glut of phosphates in the markets of the world. "Nothing can stem the demand for artificial manures; it will go on increasing with such steadiness and rapidity that the visible sources of supply will soon become inadequate. Especially is this true of phosphate of lime, and the recognition of this fact by those engaged in the fertilizer industry explains the eagerness with which fresh deposits of the material are being sought for all the world over."

Dr. Wyatt recognizes the fact that "there is a great and regrettable divergency in the results of phosphate analyses made by different chemists." He says: "To the uninitiated this is an unaccountable fact, to be explained only by a very excusable and popular conclusion that analytical chemistry is not a reliable or exact science, and that it cannot produce in practice what it expresses by equation. Nothing on earth could cast a greater aspersion on the highest of professions than this state of affairs, and yet nothing on earth could be more easily and perfectly remedied. All that is necessary is for chemists to come together and agree upon certain methods, and to invite purchasers and sellers of phosphates and manures to regulate their settlements on a *prescribed basis*." It is to be hoped that this advice of Dr. Wyatt's will be followed, for anything more scandalous than the present system of analysing does not exist. While the analyses of the buyer's chemist are almost invariably lower than those of the seller's chemist, "the uninitiated" will persist in believing either that "chemistry is not a reliable or exact science," or else that some of the persons concerned do not possess "a reliable or exact" morality.

In the chapter on "The Phosphates of North America" the history of Canadian phosphate mining is but very briefly given, with a description of the deposits, illustrated by a detailed account of the North Star Mine in Portland East, P.Q. The author says :—

"As one of the most interesting results of the extensive and costly mining operations carried out during the past few years, it has been demonstrated that the apatite does really traverse the entire stratum in which it is found, and that if it is extremely pockety and deceptive in its occurrence it nevertheless is perfectly persistent. It hence follows that all the deposits may be mined by the same method, and that since we are called upon to deal with invariably mixed up lodes, the quantity of apatite produced will be in direct proportion to the amount of rock removed." He estimates this proportion of pure apatite to other material to be about 7 per cent., and places the average net cost per ton at the mines at $10 for phosphate from 70 to 85 per cent. He says that only one-third of the total production is shipped, and that "the balance has been lost in the cobbing—a state of affairs probably unprecedented in the history of any mining operations. That few if any of the enterprises have paid any dividends on the capital, is not a matter for surprise under such circumstances as these." Dr. Wyatt's remedy is as follows: "The custom of throwing the entire cost of production upon the high grades is unfair and should be discontinued. In its stead a rule should be established of setting aside for foreign shipment only such portions of the pure apatite as may be obtained directly from the lode without hand cobbing at the surface." This, he thinks, might be one-fourth of the total output. The balance, averaging, he supposes, 60 to 65 per cent., should be ground and made into "an excellent superphosphate, containing at least 14 per cent. of soluble or available phosphoric acid." The sulphuric acid required, he thinks, could be procured from "several abundant deposits of pyrites in the immediate vicinity" of Buckingham. We cannot now enter into comment upon these conclusions further than to say that experience has shown that the phosphate deposits of Ontario differ somewhat in character from those of Quebec, and somewhat different methods of mining are found advisable; it will require years of education to produce a market in Canada for the amount of superphosphate that would be produced by the above method, and it is doubtful if our "abundant deposits of pyrites" will permit us to produce sulphuric acid as cheaply as it can be imported. Further, it is certainly incorrect to imply that two-thirds of the phosphate produced from the mines is lost in the cobbing, and has been thrown into the dumps. Under the present system of hand cobbing at well conducted mines, a large proportion of all the phosphate produced is saved, and where this method is supplemented by machine processes of separation, as practised in the mills at Buckingham, the loss becomes comparatively small. There is but little phosphate that does not require some hand cobbing, though the labor would be slight in this respect if Dr. Wyatt's suggestions could be followed. It would probably be difficult to cull from the dumps of the well conducted mines any considerable amount of phosphate rock that would analyze over 40 per cent. If a cheap chemical process could be found by which the phosphoric acid could be extracted from this lowest grade refuse it would save the life of many a languishing mine.

The most interesting, because the most novel part of the book, is that which treats of the phosphates of Florida. A theory is given as to the geological formation, and the deposits are divided into three classes :—

1. Original pockets or cavities in the limestone filled with hard and soft rock phosphates and *debris*.

2. Mounds or benches, rolled up on the elevated points and chiefly consisting of huge boulders of phosphate rock.

3. Drift or disintegrated rock, covering immense areas, chiefly in Polk or Hillsboro' Counties, and underlying Peace River and its tributaries.

Of the latter, drift or "pebble" phosphate, it is said that over an area of many hundreds of miles "Florida is virtually underlaid with a nodular phosphate stratum of a thickness varying from a few inches to thirty feet, and covered by an overburden that may be fairly averaged at about eight feet." Where these occur in the river bed they are pumped up at a cost of $1.40 per ton, ready for market, and they pay a royalty to the State of 50 cents per ton for 55 per cent. and under; 75 cents for 55 to 60 per cent., and $1 per ton for over 60 per cent. The average quality of 84 samples of pebble from Peace River was 61·75 per cent., and of 92 samples from drift beds in Polk County was 67·25 per cent.

It is the deposits of high grade rock that excite the interest and concern of Canadians. Of these we learn that there are three classes: 1. Boulders of hard rock phosphate or cleaned high grade material, of which 120 carefully selected samples averaged 80·49 per cent. of phosphate of lime, and 2·25 of iron and alumina. 2. Boulders and debris of unselected material, merely freed from dirt, of which 137 samples gave 74·90 per cent. of phosphate of lime, and 4·19 per cent. of iron and alumina. 3. Soft white phosphate in which no boulders are found, of which 148 samples averaged 65·15 per cent. phosphate of lime and 9.20 per cent. of iron and alumina. These rock deposits are described as being "pockety," but in many cases they extend over several acres. Under an overlying burden, principally sand, averaging about ten feet in depth, are enormous boulders of hard phosphate rock, cemented together with clay, or the deposit is sometimes in the form of a white plaster or friable mass resembling kaolin. The deposits vary much in thickness, but are known to be in one case 50 feet. It not only varies greatly in quality, but also in colour, being white, blue, yellow or brown. Much of it is soft when damp, but becomes hard upon exposure, and has been used for building stone before its other values were known. The presence of iron and alumina in it varies greatly, and as European buyers often limit this to 3 per cent., much of the output is unsuitable for export.

A very interesting account of machinery and methods of working is given, and several pictures greatly help the comprehension. A list of companies formed shows "a paper capital of fifty odd millions of dollars." Great difficulties exist from the unsettled condition of the country, poor facilities for travel and transport, and the inefficiency of negro labor. Dr. Wyatt sums up his account of the phosphates of Florida by saying: "The natural difficulties and impediments are at present rather discouraging, but the deposits themselves are of such immense extent, and the demand for them is likely to be so great and continuous, that all obstacles to their exploitation must of necessity be cleared away. With the disappearance of the obstacles, the material of all grades will come forward in large quantities, and as its chemical composition is very satisfactory, it will soon compete favorably for superphosphate making with any other phosphates now popular with fertilizer manufacturers."

The book would have been still more valuable if it had given fuller statistics of the amount of production up to date, and a better idea of the geographical location of the rock deposits.

The question of grinding phosphates is one of great importance, and Dr. Wyatt calls attention to four methods :—

1. French burr mill stones fitted with revolving screens up to 90 or 100 mesh

2. The Sturtevant mill, in which the rock grinds against its own material. With the attachment of a set of stones to grind the tailings, which amount to 30 per cent., "the average milled product of 70 mesh may be fairly taken as about two tons per hour."

3. "The Griffin mill, which is of the class known as a roller and die mill, in which the material is reduced by being crushed by a roll running within and against the inner surface of a ring or die." It is stated that four tons of Carolina phosphate 75 per cent. of which would pass through a 70 mesh screen, may be ground in an hour.

4. The Frisbee-Lucop mill, in which heavy rollers revolve upon the inner surface of a steel ring, and which is said to grind fifteen tons of rock to a fineness of 150 mesh in 10 hours. Dr. Wyatt estimates the average cost of grinding to 70 or 80 mesh to be $1.50 per ton.

The growing interest in phosphates makes the issue of this book a timely event, and it will find a place upon the shelves of all public or scientific libraries as a standard book of reference. Its perusal cannot fail to be of interest and service to the phosphate miners and manufacturers, and it would be of untold benefit to this country if every farmer could be prevailed upon to read the portions relating to the value of phosphatic fertilizers.

The Smelting of Copper-Nickel Ores.

Dr. E. D. Peters, jr., well known to Canadians as the first manager of the copper-nickel mines of the Canadian Copper Co., at Sudbury, where he demonstrated the feasibility of smelting these ores on a large scale in water jacket furnaces, has issued through the medium of the Scientific Publishing Co., New York, the second edition of his well known and widely read work, "Modern American Methods of Copper Smelting." The book, apart from its great value as a reference to metallurgists generally, is of particular interest to Canadians, inasmuch as it contains the latest addition to the literature of nickel metallurgy. As Dr. Peters assisted in the opening of the mines, and the first smelting works were built under his direction, he speaks authoritatively of such matters as came under his personal observation, and within the sphere of his own practice. A few excerpts from his references to the mining of the nickel in this country will not be out of place: "On an average the ore treated at the principal mines carries some 4 per cent. of copper, though, if selected, it could easily be brought up to 8 or 10 per cent. But up to the present time, experience has shown that it pays about as well to mix all the ores and smelt them as they are, as to try to make two grades of matte, one rich in copper and poor in nickel, and the other high in nickel and low in copper. By pursuing the latter course, a slighly better price can be obtained from the refiners, but the metallurgical operations are seriously embarrassed, as, if the heavy nickel ore is smelted alone, it produces far too basic a slag; while if the richer copper ore is fused by itself, the slag is too siliceous to smelt easily. By mixing the two varieties of ore in their proper proportions, a good slag is obtained without the addition of flux, not a pound of the latter being used during the time I was in charge of the work. Besides, the ores roast much better when mixed than if separate." Dr. Peters then fully describes the methods of roast-the ore, in which he calls attention to the vital importance of having a proper and well-drained roast ground. "In the severe climate of northern Ontario, it was sometimes necessary in inaugurating a new plant, to build a heap on frozen ground, or ground that was not thoroughly drained. In both cases the results were miserable, the escaping steam seeming to completely impede the combustion, and the resulting heap, when torn down, revealing isolated spots, each containing many tons of ore that were not roasted at all, only the surface being slightly scorched, though the greatest pains were taken in building and managing the heap." He points out that an absolutely dry and unfrozen ground is essential to success, and if snow falls, it must be carefully cleared away before laying the wood down, and after the wood is once in place, no snow or rain must fall upon either the fuel or ore. Where the ground is frozen, the results of the roasting are always unsatisfactory. "A few hours after lighting the heap, water begins to flow out from under it, and for a day or two, a continuous stream will pour out from the lower side of the pile, generating steam in quantities, and extinguishing the fire as soon as the lumps of ore are scorched a little on the outside." Dr. Peters then goes on to discuss the treatment of the nickel-matte, and the subject is so attractive that we cannot refrain from giving his remarks in full:—

> "In nickel smelting, when the matte is obtained it still remains to be refined, and only those who have been through such an experience realize the difficulties of disposing of it.
>
> "In the first place it becomes a question of calculation whether it will pay better to ship the matte at about a grade of 25 per cent. as it is produced from the furnace, or to concentrate it on the spot by a second series of roasting and smelting operations. Until the local condition, wages, scale on which the operations are conducted, exact character of ore that is treated, etc., are known, this question cannot be answered. The matte is enriched by roasting it and re-smelting it in a water-jacket or other furnace, with quartzose flux to take up the iron. It is a question to be determined by circumstances, whether the roasting should be executed in heaps, as with the ore, or whether it should be crushed and calcined in a few hours in calcining furnaces. Heap roasting of matte takes about as long as the ore, because it has to be re-roasted 2 or 3 times, as it does not roast freely like the ore. But as there is only about one-sixth so much to handle as of the raw ore, the expense of ore per ton is not heavy. A matte of about 50 to 60 per cent. of nickel is produced by the so-called concentration smelting.
>
> "This concentrated nickel matte has a high point of fusion and easily forms crusts and accretions.
>
> "It is impossible to smelt it in a furnace with brick fore-hearth, as may be advantageously done with the ore, for it soon fills up the front crucible, necessitating its substitution and leaving a "salamander" weighing a ton or two, that is difficult to break up.
>
> "After much experimenting I have returned to the old practice of using "steep," or a mixture of pulverized coke and clay, for a fore-hearth, cutting in it a small crucible connected with the furnace crucible by a deep groove. Out of this crucible the rich nickel matte can be either tapped or ladled into moulds, and as this method of procedure involves frequent, though very slight, repairs, it will save much delay to make the fore-hearth broad enough to permit of two such crucibles, side by side. Thus one can be repaired and dried while the other is in use.
>
> "The further treatment of the nickel matte, according to the old practice, is well known and its description would be out of place in this connection.
>
> "Being expensive and slow, efforts are being made to improve upon it, and one of the principal nickel-smelting companies at Sudbury is erecting a plant to Bessemerize this rich sulphide of copper and nickel.
>
> "According to the laws of chemical affinity, as modified by the high temperature employed, we know that the iron still remaining in the matte ought to oxidize first, forming with silica a slag that may be poured off. Next the nickel should oxidize and slag away, leaving behind the pure copper.
>
> "But whether such accurate results will be reached in practice seems to me rather doubtful.
>
> "In the Bessemerizing process, as applied to iron, the entire mass of metal remains homogeneous throughout the operation, the impurities being gradually oxidized until it is all converted into steel. And the total amount of these impurities is only four or five per cent., so that the mass of fluid metal operated upon is not perceptibly lessened.
>
> "But in Bessemerizing a mixture of the sulphides of iron, copper and nickel, the number of different chemical compounds having differing specific gravities and tending each to form its separate stratum in the converter, is too great to even enumerate.
>
> "As soon as sufficient sulphur is removed to correspond to the iron present, we shall have a layer of oxide of iron (combined with silica from the converter lining) on top, while below, the sulphides of nickel and copper will remain comparatively unaltered. Then may come a period when we have the same silicate of iron on top, followed by a little silicate or oxide of nickel, whilst some metallic nickel has formed and sunk to the bottom, and the rest of the nickel, in its original condition of sulphide, forms a stratum below the unaltered sulphide of copper.
>
> "These reactions and products increase in number and complexity as the operation advances, and remembering the great difficulties encountered in Bessemerizing even so simple a substance as copper matte, one cannot help feeling some curiosity as to the practical success of this operation.
>
> "That nickel and copper can be rapidly reduced from the condition of a matte to that of separate metals, the author has convinced himself. But business considerations prevent the further elucidation of this subject.
>
> "The final treatment of the nickel-copper alloy, or of the already separated metals, does not fall within the scope of this work.
>
> "But it must be evident to every one familiar with the facts, that the commercial electrolysis of copper on the one hand, and an electrolytic deposition of nickel in our nickel-plating establishment on the other hand, point out a path to follow that is too plain to be neglected.
>
> "And as our chemists find no difficulty in precipitating with the electric current, chemically pure copper from a solution containing both copper and nickel, and then, by slightly altering the conditions, precipitating all the nickel in absolute purity, from the same solution and with the same current, it would seem that our refiners might reasonably expect to effect the same results on a commercial scale, especially as there is practically no loss of acid in the operation.
>
> "Nor can I see any reason why nearly all our metallic nickel should be offered to the trade in little cubes less than an inch square. Of course this peculiar form has resulted from the practice of the nickel refiners to reduce the oxide of nickel obtained by the methods now in use, to metallic nickel. Being mixed with rye meal, as a reducing agent, it is formed into these little cubes, and a number of these packed in crucibles are exposed to a sufficient heat to reduce the nickel to a metal without fusing it. This makes a small porous fragment of metal suitable for solution in acids and where nickel is to be used in minute quantities. But it adds materially to the expense of refining and there is really no more reason why nickel should be so treated than copper or iron.
>
> "Although the fusion point of nickel is rather high, yet a sufficient temperature to make nickel pour as readily as copper, is obtained without difficulty in metallurgical practice, and there is little doubt that before long nickel will be refined in bulk and cast into suitable ingots, as is copper or lead.
>
> "Indeed at Vivian & Co.'s nickel works in England, a small reverberatory, heated by gas, has been in use for several years for refining nickel, some 2,000 pounds being refined at a charge; and the superb display of solid nickel articles and ingots made by Joseph Wharton, of Philadelphia, shows that he experiences no difficulty in melting and casting nickel like other metals."

Another feature of Dr. Peters' book, of interest to Canadians, is the detailed plan of the large reverberatories now being constructed by the Eastern Development Company at their mines at Coxheath, C.B. These drawings cover nine full size pages, and probably form the most complete and detailed working drawings of a modern reverberatory furnace that have yet been published. They are accompanied by exact estimates of the cost of every detail of the furnace. The book is nicely gotten up and in every sense merits the careful attention of everyone interested in the metallurgy of copper.

◆

EN PASSANT.

In the *Empire* of Dec. 1st there appears a remarkable contribution from the pen of Mr. W. J. Morris, of Perth. Mr. Morris quotes our article in the November issue referring to the singular condition of foreign markets, where a rush of Florida 75 to 80 per cent. phosphate has forced its price below that of the more scantily supplied and firmly held 60 per cent. phosphate. Referring to this, Mr. Morris says:—

> "It seems to me extraordinary that a paper purporting to be the exponent of the mining interests of the country should think that our business men are for one moment foolish enough to believe that shrewd, keen British manufacturers will pay a higher price for an inferior article than for a better one." He goes on to say:—
>
> "I cannot believe that these extracts of letters are genuine; or, if they are, are evidently written by some shipping agent who has 'sold long' and now wants to bear Canadian high grades to the advantage of his own pocket."

He further states that "the REVIEW letter says that the 'market is flooded with Carolina and Florida high grades.'" As to this last point, we will merely remark that the letter says no such thing. Our correspondents and the Editor of this paper are sufficiently well informed to know that no high grade phosphate is produced in the Carolinas. Mr. Morris, we believe, was one of the earliest in Canada to be connected with the phosphate industry, and he has shown on many occasions a zealous concern for the advancement of Canadian mining interests. But of late years, we understand, he has occupied the position of Government Inspector on "the raging canal" at Perth, and it is quite possible that while calmly smoking the beloved pipe on board his dredge his field of vision has been too limited to permit him to form wholly accurate opinions as to what is going on in the world at large. The REVIEW is a medium of thoroughly trustworthy information. When we desire to ascertain the depth of water in the Tay Canal we shall probably write to Mr. Morris as to an undoubted authority, but when we wish to learn the price of phosphate in England we shall ask the men who are working the mineral in Canada and selling it in London. The imputation which Mr. Morris makes that miners of phosphate have an interest in spreading false reports in order to break down the markets, is lacking, not only in courtesy, but in common sense. Canal business, under Government subsidies, may perhaps be run contrary to the laws of trade, but all commercial producers try to get the most for their goods, and the insinuation that the authorities quoted, who are practical Canadian miners, would attempt to bear the market price of their own goods is too absurd for further notice. Advices from London dated Nov. 25th, report sales of Canadian 80 per cent. phosphate at 10½d per unit, with offers of higher grade from a well known Templeton mine, at 1s. As Mr. Morris cannot believe that 75 per cent. phosphate has sold below 60 per cent. in London, it may interest him to know that so astute an authority as the *Engineering and Mining Journal* of New York entertains this delusion, and alluded to the anomaly in its market reports for the month of September last. The only charge heretofore made against this journal in connection with the phosphate industries has been that we were, if anything, too eager to promote its interests. It is rather refreshing to learn that we have become the dupe of "wooden nutmeg" and "basswood ham," bears, "who wish to boom foreign produce at our expense." Our mission is neither to boom nor depress, but to tell the truth, and our interest is in every legitimate way to promote the phosphate and all other Canadian mining industries. We most sincerely hope that this prophet from the Tay Canal will prove to be a wise seer by the fulfilment of his final prediction—"I am certain that next June will see Canadian high grade phosphates in large demand, and at as high prices as have ever ruled."

The establishment of Institutes of Mine Officials in Cape Breton, Pictou and Cumberland Counties, is inaugurating a good work in the establishment of mining lectures of an elementary character for the benefit of the workman. The men ought to be encouraged to express their views at these meetings, *sans ceremonie*. At the last meeting of the Pictou Institute, Mr. H. S. Poole, F.G,S., manager of the Acadia colliery, gave an interesting address on the subject of explosives.

At the Abercanaid colliery in South Wales, an electric hauling plant, capable of handling 500 tons a day and doing away with the work of 27 horses and many haulers, has recently been put into successful operation. There is a generating plant on the surface and several electrically-driven hauling and pumping engines underground, connected by cables carried down the shaft and along the roading for some 1,200 yards or more. The generating plant consists of a 40 h.p. compound engine, with cylinders 13 and 21 inch diameter, and 24 inch stroke, working at 110 revolutions per minute. The dynamo, built on a wrought iron girder bed-plate, is horizontal, compound-wound and is capable of giving 180 ampères, at 500 volts pressure, and 550 revolutions per minute. There are 3,200 yards of conducting cable, which is carried down, attached to the side of the shaft, and is run underground along the roadway, from the shaft to the hauling engine. This cable will stand a shearing strain of 10 tons per square inch. It is composed of 37 strands of No. 14 high-conductivity copper wire, highly insulated with vulcanized bitumen, double taped and served, with two layers of jute yarn compounded between each. It is protected by a double sheath of No. 8 steel wires, the first stranding being of 30, and the second of 36 wires laid reversely, the current density being only 337 ampères per square inch, and the resistance of the 3,200 yards of cable being ·3192 ohms, giving a loss of potential of 51 volts, an equivalent of 10 per cent. In the combination of motor and hauling drum for a main and tail rope system it was not only necessery to make the plant very compact, but also to construct the motor so that the several operations of starting, reversing, or stopping could be effected with the least possible trouble. These operations are carried out as easily as they are performed by machinery worked by steam or compressed air.

Some recent remarks by Mr. Alex. Brown on "Unloading Ore at Cleveland" by means of machinery, contained the following statements: In 1880 there was a demand for better facilities for handling and storing ore. Nine-tenths of it were taken out of the vessel by horse or steam power in small buckets and wheeled to the ore piles. There had been opposition by the wheelers to the use of any but hand power, and the early engines were thrown into the water. So, again, there was the same opposition to unloading machinery. But when they found they made more by its aid, they desired contracts for the season. Under the old regime it cost 35 cents per ton to unload ore; now hoisting and piling cost less than 1½ cents per ton. The shovelling in the hold of the vessel is the great expense, and the shovellers were on a strike then for 13 cents as against 11 cents per ton. He thought unloading should be reduced to 6 cents per ton. At Milwaukee the pay was 10 cents per hour, and the men are steadily employed. As to improvements in the speed of unloading, he stated: "Before the introduction of machinery it took 12 hours to unload 500 tons of ore. The same number of men can now unload 1,000 tons in 10 hours. The trouble is that the ore handlers will only work when they feel like it. The value which the machinery has been to the ore trade was proved by the fact that in 1883 the total tonnage of ore to the lower lake ports was 1,962,000 tons, while in 1890 it reached nearly 7,000,000 tons.

In a paper on "Coal Mining, Past and Present," read by Mr. Moses Morris before the Lancashire branch of the National Association of Colliery Managers, he described his first entrance to the mine, 55 years ago, when his uncle carried him down a ladder pit. He described the ladder "as not being quite a ladder," it having 18 staves broken, so that before they could get down they had to learn how to slur. The men had to carry their picks, hammers, candles, oil for their tubs, cuts, etc., in the best manner they could. He described the system of cuts or tallies for their coal, and showed the meeting some specimens that were in use at that period. Mr. Morris said it was impossible for any person who had not known those days to imagine even the changes for the better that had taken place. They sharpened their picks at the bottom, and, noticing the superstition of the miners, he remarked that a man wearing a felt hat could cause a play day in the district, as no collier would go to work if he met a man wearing a felt hat. Their tubs had no wheels, whether heavy or light, and had to be dragged upon skids with the belt and chain, a specimen of which he held in his hand. They used pieces of shining wood to show where the turning-over places were, and it was quite common for tubs to be dragged eight score yards with the belt and chain. They went at three and stopped until eight or nine for 3s. 6d. per day. Some would stop down all night, as it was not worth while going home. And every day a tub was taken for the good of the brow as it was called; pay day was every six weeks, and they had to go to Bolton to get a note cashed, and then to divide it. Mr. Morris then described the method of getting their props, and showed how at that time the men were paid for it. Every man had to draw his own props. He got 1½d. for two if they were good ones, and 1½d. each for bad ones, but if they lost two they deducted the price of 10 props. He showed the method of lighting and putting out their candles, proving that it required a certain amount of knowledge to light or put out a candle properly. As to education, they never got any. The schoolmaster had not got up when they went down the pit, and he (the schoolmaster) had gone to bed when they ascended.

During the fiscal year ending June 30, 1890, Ontario imported 800,000 tons of anthracite and 1,500,000 tons of bituminous coal and coke, and the demand grows greater year by year. During the nine months ending September 30, Canada imported 1,236,702 tons of coal from the United States, against 1,049,858 tons during the corresponding period of 1890.

In another place our readers will find the verdict of the court in the appeal of the Anglo-Continental Guano Co. vs. the Emerald Phosphate Co. The contention of the appellants was sustained and judgment given in their favor with costs. The decision upon the merits turned upon the simple rule that an action of trespass is premature until the boundaries are established—a principle that has become so well established by precedents in the Province of Quebec that it should not have been necessary for the appellants to go to appeal to have it applied.

Australia and New South Wales, ever alive to their commercial and industrial interests, have appointed their Commissions to the World's Fair, but enquiries at headquarters fail to enlighten us as to what is being done by the Canadian Government, or if any move has yet been made in the matter at all. Now we have everything to gain by the infusion of American capital for the development of our mines, and the mining industry demands a Canadian exhibit at Chicago which will eclipse in its completeness all previous exhibits, either at Philadelphia, London, Paris, or elsewhere. Surely it is full time that our authorities were making a decided move in this matter.

Further tests have been made by the United States navy to ascertain how plates of American make compare with those of European manufacture. The plates tested on the present occasion were of high carbon nickel-rolled steel, made by the Carnegie-Phipps Company, low carbon nickel-rolled steel, "Harveyised," made by the same company, and high carbon nickel-forged steel, "Harveyised," made by the Bethlehem Iron Company. Each plate was 10½ in. thick, 8 ft. high, and 6 ft. wide, with an oak backing. The plates were struck at each corner by a 100 lb. Holtzer steel shell, fired from a 40 calibre 6 in. gun. The Carnegie plates were then hit by a 250 lb. Carpenter steel shell, fired from an 8 in. gun, while the Bethlehem plate was struck in the centre by a 210 lb. Firminy steel shell from a gun of the same calibre. The resistance offered by all was regarded as very satisfactory.

In a paper read before the British Association at Cardiff, a method of sinking shafts through water-bearing strata was described. In the ordinary plan of doing this work a sump is kept in advance of the full shaft and the difficulty to be met with is in the sinking of this sump. It is proposed to locate the pump in a bore hole made before the shaft is commenced. The chief novelty is in adapting the pump to this service and the prevention of rubbish from passing down the hole and choking the pump. The writer provides against the latter by a heavy taper shield of cast steel surrounding the pump and resting on the edge of the bore hole. This shield is perforated with holes to allow the water to pass down, but so arranged as to exclude debris. This shield is very heavy and it follows the excavation around the pump and protects the latter from injury in blasting. The pump is made without a foot valve, the rod of the bucket working through the seating of a valve which rests on the top of the working barrel. By this arrangement the drawing of the bucket also draws the valve; and should the bottom of the bore hole be filled by sand this can be removed by lowering a scoop such as is used in making bore holes. The bore hole is supposed to be sunk deep enough to provide a place for this sand below the pump. He recommends duplicate pumping engines and bore holes. These holes would be 30 inches in diameter, but he does not describe his plan for sinking them.

As far as we can ascertain the moneys subscribed for the relief of the sufferers by the explosion at the Springhill Collieries will aggregate a little over $100,000. An approximate estimate of the receipts is something in the following ratio:—

Province of Quebec	$25,000
" Ontario	8,000
" New Brunswick	15,000
" Manitoba	453
" British Columbia	3,570
" Prince Edward Island	1,235
North-West Territories	1,687
Great Britain	3,416
United States	1.883
Province of Nova Scotia	40,000

These amounts do not include a sum of some $12,000 subscribed by the citizens of Halifax, and $2,770 held in Ottawa on deposit, pending a more satisfactory explanation of the allocation of the funds at Springhill. The following letter from Mayor Macpherson explains the situation very clearly:—

HALIFAX, N.S., Nov. 28th, 1891.

In reply to your letter of the 20th inst. I beg to say that the citizens of Halifax subscribed about $16,000 for the relief of those made widows and orphans by the explosion at Springhill Mines. About $4,000 of this amount was forwarded in April last. On the 15th April I received a letter from Mr. McLeod, secretary of the relief committee, asking me to deposit whatever money I had of that fund in the Bank of Montreal to the credit of Sir Donald Smith, Hon. Geo. A. Drummond, Mr. E. D. Clouston and Mr. Robert Cowans, in trust. At that time there was a good deal of dissatisfaction about the way money was being used. I wrote to Mr. McLeod and told him I had heard that the money forwarded to Springhill had been deposited and made part of an old relief fund and used for the same purposes, and if such was the case I must decline to comply with his request. Mr. McLeod never replied.

Mayor Hall, of Springhill, also told me I had better not forward the money I then held until the matter was made more satisfactory.

In September a number of the local committee came to Halifax to discuss the matter, when it was decided that if they (the committee) would make a declaration of trust of the fund and a statement of how it was being expended, the money held here would be paid in—to which they agreed; but when the declaration of trust came to hand I found it was only for the money held by me, instead of the whole fund; therefore, I declined to hand over the money until they had complied with the resolution passed at our meeting, and which they have not yet done.

The balance of the amount subscribed over and above the $4,000 paid in is on special deposit and pending a satisfactory settlement by the trustees.

Yours truly,
DAVID MCPHERSON, Mayor.

The strike at the Wellington collieries, inaugurated eighteen months ago, was declared off on the 14th ulto. Although the strikers have secured reduced working hours, their main object, namely, the recognition of the Union, has not been attained. The Dunsmuirs have started proceedings in the courts against Tully Boyce, president of the union, and T. Keith, M.P.P., for conspiracy, and both parties have been committed for trial. The proceedings created a sensation.

From returns received, we compute the ocean shipments of Canadian phosphates during the season just closed, as follows:—

	TONS.
Millar & Co	1,428
Lomer Rohr & Co	7,148
Wilson & Green	4,310
Irwin & Hopper	1,282
J. & R. Esdaile	407
Anglo-Canadian Phosphate Co	402
McRae & Co.	110
Total ocean shipments	15,087

We are not yet in a position to quote the quantities exported to the United States.

The production of Canadian phosphates in previous years has heen:—

YEAR	QUANT'Y — TONS.	VALUE.	YEAR.	QUANT'Y — TONS.	VALUE.
1877..	2,823	$47,303	1884.	21,709	$424,240
1878..	10,743	208,109	1885..	28,969	496,293
1879..	8,446	122,035	1886..	20,440	343,007
1880..	13,060	190,086	1887 .	23,152	433,217
1881..	11,968	218,456	1888..	18,776	298,609
1882..	17,153	338,357	1889..	29,987	394,768
1883..	19,716	427,668	1890..	31,753	361,045

Ocean freights during the season might be fairly averaged as follows: Liverpool, from 2/- to 7/6 per ton; London, 4/- to 10/6 per ton; Glasgow, from 5/- to 7/6; Hamburg, 12/6 to 17/6.

"'With regard to prices,' one of the leading buyers writes, 'we think the great bulk of the phosphate shipped was on last winter's sales, and what was sold here was purchased by parties over-sold on last year's prices, and they therefore could afford to pay high prices. Any sales that came under our notice were of this nature, and to quote these figures would give a wrong impression of the market during the past season.'"

About 2,000 tons of phosphate from the pits of the High Rock Mines are lying at Hochelaga for next year's shipment. Several thousand tons are also held by the other companies at Buckingham wharf.

The shipments of crude asbestos over the line of the Quebec Central Railway are reported to be in excess of last year's returns, but the exact figures will not be known for a few weeks yet.

The returns of the imports of coal by water, published elsewhere, are interesting as showing a marked increase in the consumption of Canadian coal and a diminution of foreign imports. The International, Reserve, General Mining, Caledonia and Gowrie, each show a lead over last year.

The New Vancouver Coal Company has declared a dividend of five per cent. on its operations during the past half year. The output for that period amounted to 253,296 tons, and the sales to 254,025, against 217,338 tons, and 215,000 sales in the previous half year. The balance sheet is the best ever submitted to the shareholders.

The second Annual General Meeting of the General Mining Association of the Province of Quebec will be held in the new club room of the Windsor Hotel, Montreal, on Wednesday, 13th January next. Two sessions will be held. After the election of officers, council, and other routine, papers will be read by Capt. R. C. Adams, Dr. R. W. Ells, J. T. Donald, M.A., Sir William Dawson, Prof. W. C. Carlyle, Dr. Harrington and others. The annual dinner will be held in the same place in the evening.

As the Mercier Mining Bill must be reported on during the present month, the report of the Privy Council on the petition praying for its disallowance will, in all liklihood be submitted at this Meeting. The members of the Association, while not over-confident, entertain hope of a successful issue of their appeal against this unconstitutional interference with their rights.

The Montreal *Gazette* is aggrieved at the idea of the Dominion Government interfering with the Mercier Mining Bill. It says: "It is most unlikely that the Dominion Government will take any such action. A province's administration of its financial affairs is its own concern, and when its legislators make blunders it should be left to the people to settle with them. The Dominion administration will have plenty to do to attend to its own finances. If individuals are aggrieved they have the courts to apply to." Well, it may be so; but the question at issue is not quite one of provincial finances, although in all conscience that is serious enough, but rather one essentially of constitutional administration. It is the bounden duty of the Federal Government to step in and disallow this Bill, for apart from its other objectional features, it virtually amounts to the confiscation of all the mines and mining rights disposed of without reserve on private lands. There is no question that the whole jurisprudence of the country establishes that where such lands were granted without a reserve of the minerals, all baser metals become the property of the grantee. We would suggest that our contemporary should ascertain the facts before ventilating its ignorance in this rediculous manner.

The mines in the rich mineral districts now being opened up in the Kootenay country are to a unit in favor of a substantial increase in the present duty on imported lead. With the home market, consuming now about 18,000 tons and which is steadily increasing, assured to the mine owners of British Columbia, they would feel that their industry was on a satisfactory basis. They would have an equal opportunity with producers in the United States in outside and neutral markets. There is not much probability of the United States Congress abolishing its duty on lead ores in face of the strong opposition which such a measure would meet with from the mine owners of Colorado and other States. The only alternative, therefore, is for us to preserve the Canadian lead market for Canadian producers, and then let them seek outside markets for any surplus stock.

The article on the Nova Scotia Gold Fields, by Alfred Woodhouse, F.G.S., in the October number of the REVIEW, is attracting considerable attention. The article was republished in the Halifax *Herald*, and James McDonald, an old gold miner. writes to that journal as follows:

"The article in gold mining in Nova Scotia, is one of the best articles on mining I have ever read in any paper in the Dominion. The mine owners and managers should read it carefully and put it into practice as much as possible, for any persons visiting the mining camps in our province will soon see for themselves the truth of the engineer's assertions, when he said that you were struck by the large number of small pits and trenches on the surface of the veins. It is seldom one sees a shaft over 150 feet deep. Of course there are some, but they are few and far between—like angels' visits—and the cause of the most of it is lack of capital. How many places all over the country do you hear the same old story, "lost the lead" or vein. Of course on the surface the veins are more or less thrown about and displaced, while if there was a vertical shaft sunk from 200 to 500 feet, and a cross-cut made across the formation, the veins would be found in place, and then, by careful surveying the gold shutes could be located at the exact point where it would cross the tunnel, and then followed up as it raised to the surface, instead of taking everything up hill as it is done in most of our mines, and be troubled with the water. Mining is like most any other business—it needs careful attention to make it pay; and a mine that is worked by gopher holes, as they are called out west, can never be a paying mine for any length of time. For an illustration of this, look at the old mines of Mexico that were worked on the surface and down to water level, and abandoned as worthless. Now these same mines have been bought by Americans and are paying handsome dividends to-day, and will continue to do so for years to come. Now the time is not far off when lots of old mining properties that to-day are considered worked out, will be worked by large companies and improved machinery, and will give the stockholders handsome returns for the money invested. One thing more, and that is, the royalties on copper and lead are entirely too high. On lead it is just double what it is on gold or silver; and on copper it is worse, or about one third of the market value of the ore. Now, our copper and lead mines can't stand to mine the ore and give up so much in royalties, and compete with other countries, where they pay no royalty, besides paying a high price for the areas. Besides, our Local Government should take some steps to have the royalties on lead and copper put on the same basis of gold and silver. Then there are lots of copper mines that are lying idle at the present time that would start up and give employment to hundreds of miners, and put thousands of dollars into the local treasury, and bring the Province of Nova Scotia, rich in all kinds of minerals, to the front as one of the greatest mining countries on the face of the globe."

In a paper contributed to the *American Journal of Science* by Prof. B. J. Harrington, of McGill University, the discovery of amber deposits at Cedar Lake, Man., is exploded. He says: "Though resembling amber in some of its characters, the Cedar Lake resin may here be classed provisionally as "retinite," on account of its differing from amber in its deportment with solvents, in not yielding crystals of succinic acid on distillation, and in having a somewhat different ultimate composition. The name 'retinite,' as used by some mineralogists, is a convenient general term to include such substances as Walchowite, Krantzite, Jaulingite, Rosthornite and the Cedar Lake resin, which last, by way of distinguishing it from other retinites, may be called Chemawinite (from Chemahawin or Chemayin, the Indian name of a Hudson Bay post, not far from where the resin occurs. Though the origin of this substance is not certainly known, there can be little doubt that it has been derived from one of the tertiary or cretaceous lignites occurring on the Saskatchewan. Some of these are known to contain resins, one of which, examined by the writer, was not essentially very different from the Cedar Lake material. It behaved similarly on heating, had a hardness of over 2, a specific gravity of 1·066, and dissolved in absolute alcohol to the extent of 29·30 per cent. Some of the larger pieces of the Cedar Lake resin might perhaps be employed for ornamental purposes (beads, etc.), and possibly the material might be utilized by the varnish maker. This question will be discussed when the examination of the resin is completed."

At the opening meeting of the South Staffordshire Institute of Iron and Steel Works Managers, the president pointed out the difficulty to name any metallurgical appliance which, during the last fifty years, has made such rapid and continuous progress as the blast furnace. At one time 100 tons a week, with a coke consumption of 40 cwt. or thereabouts, was considered a good production, whereas, at the present time, outputs of 700 to 900 and even 1,000 tons per week was not unusual. Such an extraordinary change in outputs and economy had only been obtained by vast changes in blast furnaces, plant and equipment, and in many cases by a total revolution in ideas of furnace practice. The influence of American practice was making itself felt more and more in England, and it was only a question of time when in England they would adopt the American system of separate furnaces, separate blowing engines, separate blast mains, separate stoves and separate lifts. He claimed that the great makes of America were, however, obtained at the expenditure of fuel which would in England be considered an ample profit, being 1½ cwt. of coke per ton over and above the consumption in England. The furnace doing the best work was that turning out about 1,000 tons per week, 17 feet high and 76 or 70 feet bosh.

A writer in the *Colliery Guardian* suggests the use of blast furnace slag for road-making. Having seen what a slag-lined road would stand he would prefer it to any substance other than granite or whinstone, as it is a substance which wears with a good face and is practically untouched by frost, a desideratum which gravel and flint do not largely possess. Besides the rough metal for the roads, all less than inch in diameter could be used for concrete or tar paving, the latter being a purpose for which it is specially suited. In addition, the slag could be moulded roughly into blocks for kerbing, and in fact paving, also, if necessary, the whole being in a molten state as it issues from the furnace.

Accustomed as we are to the collapse of great concerns and the eclipse of noted personalities, few will have read without regret the details which have been published of the fall of the great financier, Mr. Cyrus. W. Field. Equally with Lear he trusted, and worse than Lear, he has involved others in his fall. Solon said well when he told the exultant Crœsus to "call no man happy till he is dead." The deplorable occurrence is notable from the fact that Mr. Field is a heavy stockholder and a prominent director of the Acadia Coal Co., while his son, now, we are pained to learn, under arrest, is also on the board of the Nova Scotia company. How far the failure will affect the company, or whether it will seriously affect it at all, can only be conjectured at present.

Our Portrait Gallery.

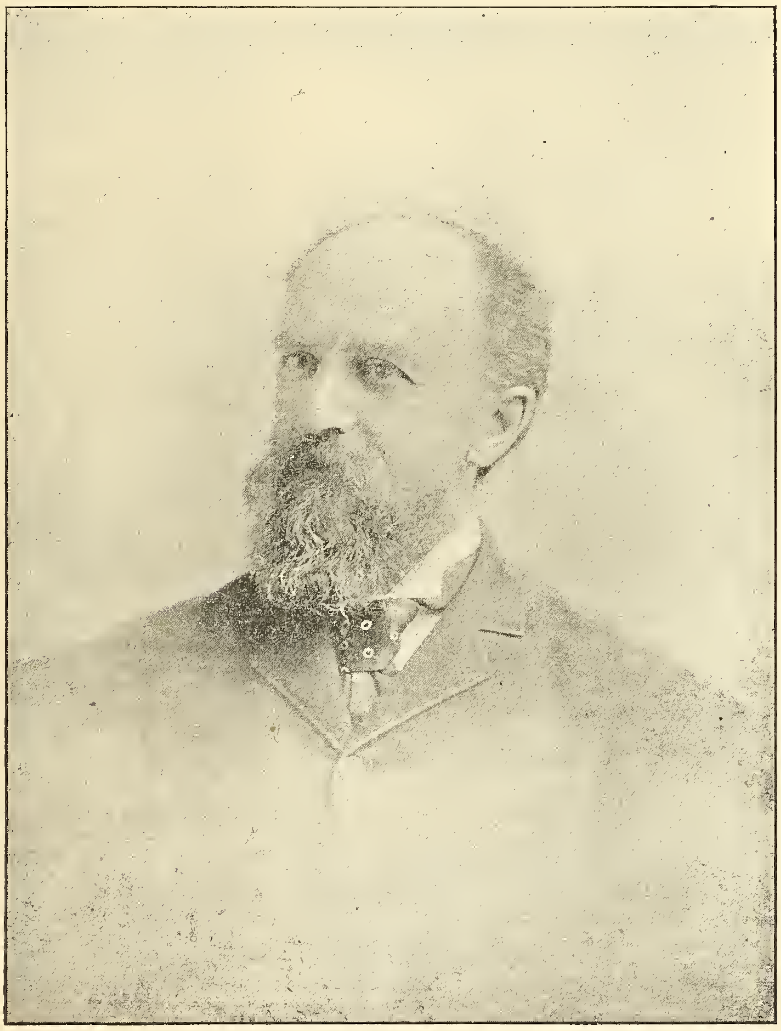
[A series of portraits and biographical sketches of Canadian mining engineers, mine managers, inspectors, geologists, explorers, etc.]

No. 14.

Bernard J. Harrington, B.A., Ph.D., Greenshield's Professor of Chemistry and Mineralogy, McGill University, Montreal.

Few men have done more, in an unostentatious way, to advance the mining industries of our Dominion than Dr. B. J. Harrington, who has not only afforded accurate and reliable information concerning our mineral deposits in his various exhaustive reports, but has also trained many able young men now engaged in professional work in various parts of the Dominion.

He was born at St. Andrews, P. Q., where his father's family have resided for several generations, on the 5th of August 1848. His mother, who was a Miss Seymour, was also a Canadian, having been born in the Eastern Townships of the same Province. Owing to weak eyesight, from which he suffered while a boy, he was not sent to school, but received his elementary education chiefly from private teachers. At the age of 17, however, he matriculated at McGill University, and four years later graduated as Bachelor of Arts, obtaining first rank honours in natural science and the Logan gold medal. He then continued his studies in the Sheffield Scientific school of Yale College, New Haven, Connecticut, where he remained as a "post-graduate" student for two years, devoting his attention principally to chemistry, mineralogy and metallurgy, and at the end of that time graduated with distinction as Doctor of Philosophy, obtaining also the prize in mineralogy, Dr. H. S. Williams, now Professor of Geology at Cornell University, obtaining this degree, which has been but seldom granted, at the same time. Dr. Harrington took as the subject for his thesis the "Siemens-Martin process for the production of Steel."



Sincerely Yours
B. J. Harrington

Shortly after this Principal (now Sir William) Dawson was appointed by the Government of Prince Edward Island to examine that province and report upon its economic resources, especially as to the possibility of finding coal on the Island, and Dr. Harrington was selected as his assistant. The results of this survey are to be found in a report published by the Government of Prince Edward Island.

In the summer of 1871, Dr. Harrington was appointed Lecturer in Mining and Chemistry at McGill University, and the following year crossed the Atlantic and spent several months in the principal mining and manufacturing centres of the mother country. On his return he was appointed Chemist and Mineralogist to the Geological Survey, which position had been just rendered vacant by the resignation of Dr. T. Sterry Hunt. The Survey was at that time located in Montreal, and for the following seven years Dr. Harrington discharged the duties of both positions. The present chemist to the Survey, Mr. G. C. Hoffman, was engaged to act as his assistant.

In 1876 he was married to Anna Lois Dawson, eldest daughter of Sir William Dawson, and in 1879, increased duties at the University obliged him to resign his connection with the Geological Survey. Since that time his attention has been devoted exclusively to University work, the rapid growth of McGill University, and especially the greatly increased number of students in the Faculty of Applied Science, necessitating every year more extended courses of instruction.

In 1883, he was appointed David Greenshields' Professor of Chemistry and Mineralogy, retaining at the same time, the position of Lecturer in Mining and Metallurgy. This latter position, however, he retired from during the present year, Mr. W. C. Carlyle, B. A. Sc., a young mining engineer who has had extended experience in Colorado, having been appointed as special Lecturer in these subjects, leaving Dr. Harrington to devote his whole time to chemical and mineralogical work.

We are indebted to Dr. Harrington for many contributions to science, especially in the domain of Canadian mineralogy. One of his earliest papers we believe, was that entitled, "Notes on the Botany of the Counties of Hastings and Addington, Ontario," published in the *Canadian Naturalist* in 1870. "Notes on Dawsonite, a new Carbonate;" "Notes on a few dykes cutting Laurentian Rocks;" "Notes on a few Canadian Rocks and Minerals;" "Notes on Chrome Garnet, Pyrrhotite and Titaniferous Iron Ore;" "Notes on the composition of Dawsonite;" "Notes on Gothite, Serpentine and other Canadian Minerals;" "On Canadian Spessertite and Mountain Cork," are to be found in the same journal.

To the *Transactions of the Royal Society of Canada*, Dr. Harrington has contributed the following papers: "On some Minerals new to Canada;" "On some Canadian Minerals;" "On the sap of the Ash-Leaved Maple (*Negundo Aceroides*);" "Notes on specimens of Nephrite from British Columbia." He has also published a valuable paper on the Grantham Iron Works of Drummondville, P. Q., in the *Canadian Magazine of Science and the Industrial Arts*, as well as one on the Pyrrhotite from Elizabethtown, Ont., and quite recently another "On the so-called Amber of Cedar Lake, North Saskatchewan, Canada," in the *American Journal of Science*.

Dr. Harrington is also the author of many Reports on our ore deposits and minerals of economic importance. These are to be found in the publications of the Canadian Geological Survey. The most important of these are "The Iron ores of Canada and their development," published in 1874-75, and the Report on the Minerals of some of the Apatite-bearing veins of Ottawa County, P.Q," which appeared in 1879. The former was reproduced as a series of articles in the London journal *Iron*, while the latter is the best account which we possess of the nature, mode of occurrence and probable origin of our apatite deposits. He is the author of the "Descriptive Catalogue of the Economic Minerals of Canada," prepared for the Paris exhibition of 1878, as well as of the greater part of the similar catalogue prepared for the Philadelphia exhibition. His principal contribution in other fields than those of science is his Life of Sir William Logan, a large volume of over 400 pages, published in 1883.

Dr. Harrington has been President of the Natural History Society of Montreal, and was for many years editor of the *Canadian Naturalist*, now the *Canadian Record of Science.* He has also, on the various occasions when Montreal has been visited by the great learned societies, taken an active interest in the pleasing task of entertaining them, as many of those who have attended the meetings will remember.

Since severing his connection with the Geological Survey, in addition to a somewhat extensive private practice, Dr. Harrington has been professionally employed several times in great law suits and arbitration cases. He has an especial gift for teaching, to which, of recent years he has devoted himself almost exclusively, and especially the power of inspiring his students with enthusiasm for their work. The important positions which they have taken, not only in Canada but in various parts of the United States, reflects the greatest credit upon him. In addition to his purely academic degrees, Dr. Harrington is a Fellow of the Royal Society of Canada, as well as of the Geological Society of London, and a member of the American Institute of Mining Engineers.

◆

The following statistics of the shipments of 75-80% Florida phosphate from the port of Fernandina, Florida, are from our own correspondent :—

		Tons.
January to October inclusive, and previously reported		35,462
Nov. 2, British str. Endeavor	Stettin	2,000
10, " " Cyanus	Hamburg	2,023
12, " " Topaze	Belfast	1,152
16, " " White Jacket	Hamburg	2,089
17, " bqe. Iron Queen	Ayr	364
17, Am. schr. Douglas Gregory	Baltimore	1,000
Total to November 17, 1891		44,090

Mr. Lucius J. Boyd, M.E., is reported to have discovered diamonds (not black), in Cape Breton. Comment is unnecessary. Next !

The net earnings for the first four months of the present financial year of the Alaska Treadwell Gold Mining Company are officially stated to have been $166,726.26, or at the rate of $500,000 per annum. This profit has resulted from mining and reducing hard and refractory quartz, yielding (including the returns from chlorination), only 3½ dwts. of gold per ton, the total expense being about 1⅜ dwts. per ton.

The announcement in London that the Bell's Asbestos company had decided to close down its mining operations for the winter, in consort with the other Canadian companies, had a very depressing effect upon its stock quotations, and the price fell over 10/-, £5 shares being quoted at £6. Since then, however, someone has evidently been picking up cheap stock, with the result that at last reports the quotations had advanced to 7½, buyers closing round about 7 1/16.

We are curious to know if Mr. R. H. Ahnn (when a simple jeweller, he used to spell his name without the h), who claims to be a mining engineer and metallurgist of many years' standing, is the same party who wrote the other day to a worker on the staff of our Geological Survey with a request to recommend to him a good work on mineralogy *for a beginner ? ? ? ? ? ?*

Readers who desire to fyle their copies handily for reference, should get one of our red cloth binders with embossed title and stiff covers. We will mail one to any address on receipt of one dollar. This is the best method of preserving your copies.

A complete alphabetical index to the volume brought to a close with the present issue of the Review will be furnished with our next number.

We return our best thanks to those kind and courteous contributors, our correspondents and the many good friends who have so materially assisted us by their co-operation during the year. We wish you one and all the compliments of the season.

Plumbago Mining in Ceylon.

The following is a description of the manner in which the natives of Ceylon mine for plumbago. A native usually drives a shaft until he is no longer able to contend with the flow of water in the mine. He then stops working and afterwards drives galleries, and this he continues to do as long as his lamps will burn ; but the moment they are extinguished by the gases collected in the gallery he ceases working in that part and continues upwards, refilling the shafts he has dug with the debris from the mine. In other cases, instead of sinking a shaft, a large open cutting is made, in which the vein is followed, and galleries afterwards run as occasion may require. There is no system for ventilating the mines, and the result is that after a blast much time is wasted before the mine is sufficiently cleared of foul gases to allow working to be resumed. The great object of the native proprietor is to keep his expenses as low as possible. As to the timber he is using he knows nothing of its strength, and is quite unable to work out the strain it will stand. He doubtless knows certain timber will resist damp, and is stronger and tougher than other woods ; but as the wood is generally green and full of sap, it cannot resist the ravages of damp as it would do if it was properly seasoned. The result is that the shafts and galleries are frequently insufficiently timbered. The windlass used is frequently not strong enough, and has no ratchet-wheel, so that serious accidents may occur in raising and lowering miners. The rope is the ordinary coir rope of the country, the strength of which varies very much according to the make and the quality of the fibre used. Instead of rope, ladders are frequently used by the miners, and these are made of the roughest materials and frequently tied with jungle rope or ordinary coir yarn. There is no regulated distance between the rungs, and the ladder is placed perpendicularly to the bottom of the pit, and when it is remembered how highly lubricated the wood must get from the hands and feet of the natives who have been working plumbago, the great danger they run every time they mount and descend can be well conceived. Various minerals are dug out of plumbago mines with which the natives have no acquaintance, and consequently are sometimes thrown away. Pitch-blende, known as a valuable ore of uranium, has been found inside plumbago; pyrrhotite also is found largely in plumbago mines, from which, in other countries, the greater part of the nickel of commerce is extracted.

◆

A New Use for Old Steel Rails.—In the window of Messrs. Brackenridge & Co., King Street, are models of Barnes' patent steel rail pit props and framework for collieries, mines, shafts, tunnels, aqueducts, bridges, jetties, gantries, culverts, sewers, flues, cattle-creeps, cellaring, supports, etc. The objects of the invention are to utilize old or defective rails, both of which are equally serviceable with new rails, and to provide props and other supports of great strength and security, which, from their material are practically imperishable, and will also be eventually cheaper than any form of mining supports. Mr. Barnes has made use of iron and steel rails, which are cut into suitable lengths, and by slots or notches at the ends, are shaped so that they can be easily framed together. We are informed that the Whitehaven Colliery Co. is testing several main road sets, and that they have stood unaltered in position, under the greatest possible pressure and strain, and the sole strut sets have effectually prevented the heaving or rising of the floors. The company speaks highly of the systems, and intends extensively adopting them at all its pits.—*Ryland's Iron Trade Circular, Birmingham.*

Coal Imports by Water at the Ports of Montreal, Sorel, Three Rivers and Quebec for the Years 1890-1891.

(Authentic returns compiled for THE REVIEW.)

MINE.	MONTREAL.		SOREL.		THREE RIVERS.		QUEBEC.		TOTALS.		TOTALS OF EACH FIELD.	
	1890.	1891.	1890.	1891.	1890.	1891.	1890.	1891.	1890.	1891.	1890.	1891.
CAPE BRETON.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
" International "	89,138	103,967	1,400	....	....	....	2,871	4,954	93,409	108,921	....	....
" Reserve "	62,798	84,082	14,800	8,317	....	4,300	8,094	11,212	85,692	107,911	....	....
General Mining Association	42,365	40,819	9,000	26,840	10,046	4,173	24,636	24,011	86,047	95,843	....	....
" Caledonia "	70,187	69,317	10,800	18,764	1,690	....	3,259	940	85,936	89,021	....	....
" Gowrie "	45,339	58,200	3,540	1,806	....	....	4,000	25,99	52,879	62,605	....	....
" Glace Bay "	51,000	53,324	3,680	....	....	....	1,634	412	56,314	53,736	....	....
" Bridgeport "	....	....	....	....	....	....	7,132	....	7,132	....	467,409	518,037
PICTOU COUNTY.												
" Intercolonial "	45,857	40,420	7,100	....	....	....	....	276	52,957	40,696	....	....
" Acadia," " Vale " and " Albion "	6,316	4,193	....	....	....	....	....	....	6,316	4,193	59,273	44,889
Total Domestic	413,000	454,322	50,320	55,727	11,736	8,473	51,626	44,404	526,682	562,926	526,682	562,926
Scotch	32,077	15,193	....	....	....	....	5,259	11,078	37,336	26,271	....	....
English	8,000	5,282	....	....	....	....	3,578	7,844	11,578	13,126	....	....
Welsh Anthracite	1,010	2,394	....	....	....	....	....	....	1,010	2,394	49,924	41,791
Total Foreign	41,087	22,869	....	....	....	....	8,837	18,922	49,924	41,791	....	....
Grand Totals	454,087	477,191	50,320	55,727	11,736	8,473	60,463	63,326	576,606	604,717	576,606	604,717

LEGAL.

Putnam vs. Hardman et al.

The second trial of this action was concluded on 3rd ult. at Halifax, N.S., before Mr. Justice Townshend, with a jury.

In addition to what was claimed at the first trial in May, 1889, the plaintiff claimed an interest in certain gold areas purchased by defendants in September, 1887, and now known as the "Standard Gold Co." Upon these new issues the jury found for the defendants. The questions submitted to the jury were decided, in the main, in favor of the defendants, and the result is practically a victory for them, although the verdict was a mixed one. The issues and answers are as follows:—

1. Does the draft memorandum made about the 14th October, 1884, contain the true agreement between the parties, as alleged? Ans.—Yes. (In favor of plaintiff).
2. If it does, was it a further term of the understanding between the parties that there was to be a further agreement between Putnam and Taylor as to their interests as between themselves, apart from Hardman? Ans.—Yes. (Favor of defendants).
3. Was the draft memorandum entered into subject to a favorable report from Taylor on his return from Nova Scotia? Ans.—Yes. (Favor of defendants).
4. Was such favorable report made by Taylor on or about the 21st October, 1884? Ans.—Yes. (Defendants' favor).
5. Did plaintiff agree to become a partner in the enterprise until after Taylor's return from Nova Scotia? Ans.—Yes; subject to Taylor's favorable report.
6. If not until after his return on the 21st October, 1884, did plaintiff thereafter agree to become a partner before the 5th Nov. 1884? Answered by the fifth answer.
7. If there was to be a further agreement, was the agreement alleged by the defendants as made on the 5th of Nov., 1884, the true one, whereby plaintiff was to lose all his interest in the co-partnership if he failed to supply all the capital for the purchase of the properties and $10,000 working capital, and to relieve defendant Taylor from all liability on his notes before December 1st, 1885? Ans.—No. (Plaintiff's favor).
8. If yes, did plaintiff furnish all such moneys and relieve defendant Taylor of liability on his notes before December 1st, 1885? Answered by previous answer.
9. Did defendant Hardman obtain the power of attorney at the time he did with intent to defraud plaintiff of his title in the property, or was it obtained with the bona fide purpose of preventing the forfeiture of the leases? Ans.—Not with any intention of fraud. (Defendants' favor).
10. Were the properties mentioned in page 4, paragraph 14, of the statement of claim, and purchased about September, 1887, purchased with money belonging to the alleged co-partnership? Ans.—Not proved. (Defendants' favor).
11. Were the properties mentioned in paragraph 15 of the statement of claim, and purchased about September, 1887, purchased with money belonging to the alleged co-partnership? Ans.—Not proved. (Defendant's favor).

This verdict probably settles a case which has been in the courts for nearly five years, and which has been of much interest in Nova Scotia. The properties involved were sold by order of the court eighteen months ago, and are now being worked by the Oldham Gold Company.

Dowsley vs. Odell.

A case of some interest to our readers was heard before Chancellor Boyd on the 28th and 29th days of October last at the Chancery Sittings held in the City of Ottawa.

The action was one brought by Thomas Dowsley, a real estate agent of the City of Ottawa, against the executors of the late H. C. Odell, to recover from them the sum of $500, which Dowsley claimed to be entitled to for the sale of phosphate lot No. 17, in the 6th Range of Portland West, in the County of Ottawa, under the following agreement between him and Odell:

THOMAS DOWSLEY.

Dear Sir,—If you sell for me, or through your influence I sell, my mining right of lot No. 17, in the 6th Range of Portland West, for the sum of $10,500, I will pay you a commission of $500 on completion of sale.

(Sgd.) H. C. ODELL.

Ottawa, 19th Sept., 1889,

On the same day on which this agreement was entered into between the parties Odell gave Dowsley an option in the name of one John Vansickle for the same property, at $10,500, which was to remain in force from the 3rd to the 13th day of October, one Dwyre having an option for the property expiring on the 3rd October.

A short time prior to the above dates, viz.: about the latter part of August and the beginning of September of the same year, one James Grant, of New York, was negotiating for the purchase of the property in question, and in the beginning of September he came to Ottawa, and in company with Dwyre went over and inspected the property, but returned to New York without purchasing.

For some time after his return to New York, Grant corresponded with both Dowsley and Dwyre in reference to the property, but finally, in October, when Dowsley's option in favor of Vansickle was about to expire, he entered into negotiations with and purchased for $10,500, direct from Odell, the owner of the property, the transfer of which to Grant was completed a few days after the expiry of the option.

In addition to Dowsley's own evidence at the trial, on behalf of the plaintiff was read the evidence of James Grant and L. H. Connant, taken on commission in New York.

As Odell was the only one who really knew all the circumstances in connection with the transaction, and as his executors personally knew nothing whatever about the negotiations which brought about the sale, they were at a serious disadvantage in regard to their defence, the only evidence which they had to offer being that of Dwyre, who claimed the sale was brought about by him, and that of C. H. A. Grant, of Montreal, through whom the purchase was completed on behalf of James Grant, his uncle.

After hearing the evidence the Chancellor held that the purchase, though completed after, was made before the expiry of Dowsley's option in favor of Vansickle, that Dowsley assisted in bringing about the sale, and that Odell, when negotiating with Grant for $10,500 contemplated giving Dowsley $500, and judgment was accordingly given in favor of Dowsley for the amount of his claim, with interest and costs.

Anglo-Continental Guano Works Co. vs. Emerald Phosphate Co.

Judgment in this case was given by the Court of Queen's Bench, Montreal, on 26th ult. Present: Chief Justice Lacoste and Justices Bosse, Blanchet and Wurtele.

CHIEF JUSTICE LACOSTE said the respondent was working a phosphate mine on lot 19 of the 12th Range of the Township of Buckingham. The appellant was working on the south half of lot 18. The respondent petitioned for an injunction against the appellant to prevent him from encroaching on lot 19 in his mining operations, and based his demand on a possession, dating from 1875, up to a line drawn in that year by Rainboth, surveyor. The appellants pleaded to the form that the plaintiffs were described in the writ as having their place of business at Buckingham, whereas it was in the State of New York; that the nature of the demand did not justify the adoption of summary proceedings applicable to the writ of injunction, and that the delay for summons was consequently insufficient; that the day for the return of the writ was not fixed by the judge; and lastly, that the affidavit and petition were vague and did not disclose a right to an injunction, or show that the respondent would suffer serious or irreparable damage if the writ was refused. On the merits the appellant denied any encroachment, and pleaded that the proper remedy was an action of *bornage* to determine the true boundary line. As to the exception, the decision of the court below was correct. As to the merits it would appear from the pleadings that the encroachments complained of occurred on part of respondent's land adjoining appellant's. The question of encroachment could not be decided before the true boundary line was determined, and a *bornage* was the mode of determining this line. Our courts had often refused to adjudicate upon the rights of parties as to disputed limits until a *bornage* had taken place. It had also been decided that a petitory action could not be brought for encroachment until the boundaries had first been settled. His Honor cited Fraser vs. Gàgnon, 4 Q. L. R. 381, and Milliken vs. Bourget, Montreal Law Reports, 5 Q. B. 300. The remedy for injunction should not be granted where the right alleged is open to dispute, and especially in a case like the present, where the proper course is to proceed by an action *en bornage*. The following is a complete translation of the verdict:—

"The court, after having heard the parties by their respective counsel upon the appeal taken in this cause, examined the record and proceedings and upon the whole maturely deliberated.

Considering that it is unnecessary to adjudicate upon the appellant's petition for suspension of the injunction, seeing that it was adjudicated upon at the same time as the merits of the writ of injunction;

Considering that the judgment appealed from adjudicated properly upon the plea to the form filed by appellant in the court of first instance as well as upon the motion to have appellant fined $2,000 made by respondent's petitioner in the courtof first instance;

Doth confirm the judgment appealed from, to wit, the judgment rendered by the Superior Court sitting at Aylmer, on the third day of June, one thousand eight hundred and ninety-one, in so far as it rejects the said motion of respondent to have appellant fined as well as the said plea to the form filed by the appellant.

And adjudicating upon the petition of the said respondent for injunction and upon said injunction,

Considering that it is established that appellant's mining operations, which respondent wishes to stop by an injunction, were carried on at the border of the properties of each of the parties respectively;

Considering that the division line between these properties has not been established by boundary proceedings;

Considering that under these circumstances there was no case for the granting of an injunction, and accordingly that in the judgment appealed from there is error upon the merits of the demand for an injunction;

Doth maintain the present appeal with costs as to that part of the judgment which declares the injunction good and valid, and doth in consequence quash the said writ of injunction and dismiss the petition for the same, with costs; and

The Court upon motion of Messrs. Laflamme, Madore, Crosse & Larochelle, attorneys for appellant, doth grant them distraction upon the present appeal.

It is understood that the Emerald Co. will carry this case to the Supreme Court at Ottawa in appeal.

Wilson Pyper vs. Thomas Keith, M. P. P., and Tulley Boyce.

This was an action raised in Nanaimo, B.C., charging defendants with having conspired together as representatives of the Miners and Mine Laborers Protective Association of the Island of Vancouver, to prevent complainant from following his calling as miner. Judge Harrison, S.M., on the bench. D. M. Eberts, Victoria, appeared for complainant, and J. Campbell, Nanaimo, for defendants. The trial occupied several days.

The Judge carefully went over the various depositions. He considered that the defendants had gone beyond the objects stated in the rules of their Association. They had dictated to men, who were not members. It seemed to him that they had used more than moral persuasion. Under such proceedings the rights of the coal miners were completely lost. The Association was not properly organized, and was not recognized by any law in the land. He though it would be a very violent thing to stretch the regulations of the Association to include what had been done in this case. They had not simply gone to the New Vancouver Coal Co., and said we will not work for you, if you employ these men, but they went to the men, and said you must join our Association and pay assessments, besides this they insisted on their paying back assessments before they could put a pick in the ground. This is not what could be called a trade combination,—it went beyond that. The defendants had no authority whatever to make the agreement with Mr. Robins, nor to enforce it, which they had done by the most stringent means. He would commit the two defendants, Thos. Keith and Tully Boyce, for trial.

The third defendant, Arthur Wilson, against whom there was very slight evidence would be bound over to answer to any indictment that might be brought against him.

Bail for the defendants, Keith and Boyce, was placed at $1,500, themselves in $750, and two sureties of $375 each.

In the case of Arthur Wilson, bail was fixed at $500, and two sureties of $250.

Bail was immediately furnished in each instance, and the proceedings closed.

Ritchie vs. The Canadian Copper Co.

Suit has been brought into the Court of Common Pleas at Cleveland, O., by Samuel J. Ritchie and Sophronia J. Ritchie against the Canadian Copper Company, Sudbury, and the Anglo-American Iron Company, whose head offices are in Cleveland, asking for dissolution and the appointment of a receiver. Ritchie being the owner of more than one-fifth of the capital stock in each of these companies is, under the laws of the State, enabled to place the corporations in liquidation on account of the failure of the management to make any account to the stockholders. The Canadian Copper Company has a capital of two and one-half million dollars, and the Anglo-American Iron Company a capital of five million. These two companies are the owners of the famous Sudbury nickel mines from which the United States Government purchased its supply of nickel for armor plates for use in the navy.

J. Lainson Wills vs. Stewart.

An action between these parties has been entered for trial at the Superior Court at Aylmer, Que. Wills avers that defendant, who was the vendor of the High Falls phosphate properties to the General Phosphate Corporation, is indebted to him to the extent of £1,000, being a 2½ per cent. commission on £40,000, the purchase price of the said lands. Stewart refuses to pay Wills more than £560 sterling, being 2½ per cent. on £17,600 sterling. The parties to this suit are prominently identified with the General Phosphate Corporation, and some interesting revelations are promised when the case is called.

Johnson Asbestos Co. vs. Bell's Asbestos Co.

A verdict in the *bornage* suit of these companies has been granted in favor of the plaintiffs. The Bell's Company will take the suit to appeal.

A New Weldless Steel Chain.—The process of stamping chains out of a bar of mild steel, to work which a company was formed in Birmingham, Eng., about 18 months ago, has just been perfected by the inventor, M. Rougier, of that town. The chain is formed from a specially rolled bar, of which the section is a cross with arms of equal length. This bar is cut into egg-shaped links with solid studs. These studs, the absence of welds, and the homogeneity of the chain combine to make it strong, and its resistance is enhanced by subjecting the links to pressure. There are ten processes, of which all but two are automatic, and all are applied to the cold metal. A short time ago, when a number of gentlemen interested assembled at the works at Aston to see the chain made, it was subjected at one stage to torsion for the purpose of separating the links, but as this was found to fatigue the metal too much, a simple process of direct fracture has been substituted, which is said to answer admirably. The tools at present mounted are making ½ inch chain, which, according to tests made at Lloyd's, is reported to be as strong as a 1 inch welded studless iron chain. The future of the new process will be watched with great interest.

Nova Scotia Gold Fields.

By Geoffrey F. Monckton.

The gold fields of Nova Scotia cover 6000 square miles, about 50 of which are being, or have been, scratched. The rocks in which the lodes are contained are supposed to be Cambrian, and are quartzites and slates. The slate sometimes contain gold, and one case at least occurs where the sides of a crack in the quartzites were lined with specks of gold. The lodes are quartz, and generally follow the strata in dip and strike, but occasionally cut them, when they are called "anglers." The beds having been tilted, form anticlinals exactly similar to the saddle formation of Australia and California. On the question of the permanence of the lodes, Professor B. Silliman said: "There is no reason to fear that there will be any failure in depth in gold product or strength. The formation of the country is on too grand a scale geologically to admit of a doubt on this point so vital to mining success. Some of the lodes may be traced for miles.

The province of Nova Scotia has not produced as much as would be expected from thirty years' work, but the causes are not far to seek. It is for the most part covered with thick woods, intersected by deep and rapid rivers, and the surface soil is generally deep and wet. Its inhabitants are not a speculative race. Those among them who are enterprising invest their money in shipping, which yields an immense profit, and the capital required to build wooden ships is not large. The law renders it easy for a man to obtain a good title without working a property, and the consequence is that large areas are held by men who cannot or will not work them.

Mining is usually carried on in this manner: The owner of a property leases it to a company for six months or a year. These tributers will comprise a few working miners, a storekeeper who pays his calls in provisions and supplies at a modest 300 per cent. profit, and perhaps a small capitalist who pays in £10 or £20. They begin at the top, and take out everything that holds gold as they go down. They use as little timber as possible, and if the lode is wet only work on fine days. If the lode does not pay from the start one or two months will see the end; if it pays, they surrender the mine at the end of their lease to the owner of the property, and he demands an exorbitant rent which results in the mine being shut down. In rare cases he works it on his own account. Yet in spite of this system many mines have reached a depth of 300 feet, and the Wellington was worked to a depth of 1000 feet along the pay streak.

It is generally supposed that there is only one pay streak on a lode, but this is because the companies have not sufficient funds to explore the lodes, but are obliged to confine themselves to the rich part that they happen to strike on the surface. Where sufficient capital has been available, more than one pay streak has been found. The divining rod is in constant use. It is not, however, the hazel wand, but an arrangement of whalebone and brass (this last indispensable). Very large sums of money have been wasted on it, but the profitable mines found by means of the divining rod do not exist. Romantic stories are told about the discovery of several of the mines. That at Salmon River, which has yielded £140,000 in ten years, was found in this wise: A woman lose her cow. Thinking it had strayed into the woods for food, as the cleared land in that district forms only a fringe along the shore, she hired an Indian to look for it. He set out with a white man, and after searching five miles back they sat down on a boulder to rest. The white man amused himself with knocking the corner of the boulder with the back of his axe. A broken piece contained a yellow lump, which he contemptuously tossed away. The Indian picked it up, and asked him to lend his knife to cut out the yellow lump, but the other refused to allow it to be blunted by cutting rocks. So the Indian said it was no use looking for the cow any more, and carried the piece home. Apparently he sold his right to his discovery to every man he met, which resulted in several lawsuits. The boulders lying round were so rich and plentiful that for the first month all expenses were paid by breaking them up and mortaring gold out by hand. The lodes dip north and south. The main south one is 8 to 4 feet wide, and the north one 12 to 24 feet thick. Another large lode underlies this one, and there are doubtless many others on the property. The deepest shaft is 250 feet, and the length of the pay streak 700 feet horizontally. The mine is efficiently equipped with hoisting gear driven by cable by water power of 120 horse power, and there is an old 29 and a new 40 stamp mill driven by water power also, which is supplied by a fall from 140, which horse power could be obtained. The rich mines of Molega, which have for some years yielded about £10,000 annually, were found in a still more remarkable way. An American lady, who was in the habit of consulting the spirits, for several years used to come to Nova Scotia and camp out in the woods in summer with a few men to dig wherever the "spooks" kindly directed her. In 1885 they ordered her to go to Molega Barrens [the word barrens signifies a place over which forest fires have swept], and put a blast in a boulder which they revealed to her. Then large nuggets would appear in it. She went, and had the shot fired, but the gold that showed was finely disseminated. So she thought she had better wait for another revelation. Now, it happened that a man, who was not burdened with too much unearned increment, was in the woods and heard the people talking. Hiding behind a rock he watched the whole proceedings. Having no qualms about spirits, he promptly took out all the gold he could, and took up the mining rights. It is said that he made £400 in a fortnight by mortaring. The Americans have lately invested largely in this district.

The other principal gold mining localities are Goldenville, which has produced £500,000; Waverley, £212,000; Oldham, £152,000; Montague, £133,000; Renfrew and Wine Harbour, £117,000. The total product has been £2,050,000, but scientific men say that from one-half to one-fourth as much more has been wasted, as no concentrators are used. The tailings are always reworked at a considerable profit on the removal of a mill. Mines are hardly ever tested unless they show a good deal of visible gold. Yet it is recorded that a lode at Oldham, showing no gold, yielded six ounces to the ton in a mill. J. A. Phillips said that the Nova Scotian lodes were richer in visible gold than those which he had seen in any part of the world. Cases have been known of mines in the Western United States having been "salted" with Nova Scotia specimens. Of bonanzas, that at Carribou, where a stope 40 feet long, 120 feet deep, on a small lode, gave 12,000 ounces, and one recently struck at Oldham 30¼ tons from which yielded 875 ounces, may be cited. There can be no doubt that gold mining in this province has, on the whole, been very profitable, as, since there is a tax in proportion to the amount of gold produced, the output recorded is not likely to be overrated, but on the other hand, the returns of work done by which many of the claims are held, and which therefore are not likely to be too low, show a cost of £1,300,000. All titles are registered in the Crown Office, mining leases and licenses being held direct from the Government, and are perfectly secure as long as the lessee complies with certain very simple conditions.

What the mining industry requires is enterprising capitalists; the workingmen themselves have no superiors. Mines cannot be made in hard rock without the expenditure of some capital first. One of the great advantages of the mining districts is the number of lodes lying parallel and generally within two or three feet of one another, so that a company with plenty of capital has several strings to its bow. Large lodes or "belts" of lodes exist holding 10 to 40 feet of ore. Shafts cost on the underlie 30s. to 50s. per foot; tunnels 10s. to 35s. per foot. Milling by waterpower costs 3s. and by steam 5s. The actual cost per ton altogether is 80s. in a 3-inch lode, 18s. in a foot lode, and 10s. in a 4-foot lode.

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*Mining Journal.

Progress of Protective Measures for the Coal Miner.

The progress of protective measures for coal miners has been slow. Indeed, only within the last half century has any considerable advance been made, though in no other field could the genius of man have found more important work. With the exception of efforts to secure the excavation from falling in, protection against explosions was the chief question with early managers, as it is to-day in the public mind. Health demands received but little consideration. Naturally, since they were ignorant of the nature of fire-damp, knew only that its ignition caused an explosion, and did not know the great part that ventilation (of which they understood little) could perform in reducing the destructive power of the gas, their efforts were directed towards the obtention of a safe light. Phosphorescent fish skins, mirrors for reflecting sunlight into the mine, Carlisle Spedding's "steel mill,"—a device for obtaining a continuous stream of sparks from flint, and the cause of numerous explosions, instead of a safeguard—had their terms of service, until Sir Humphrey Davy produced his well known lamp in 1815. It is interesting to note that the miner owes the noblest gift he has ever received to men wholly unconnected with mining affairs. Davy was a chemist; Dr. Gray, his friend, through whose immediate efforts Davy's genius was enlisted in the miner's behalf, was a clergyman; and Mr. Wilkinson, who, in the face of popular distrust, organized the society for securing an intelligent study of explosions, was a London lawyer. The safety lamp will, alone, keep Davy's memory green as long as mines of coal endure. But no "safety lamp" is absolutely safe, except in careful hands, and, as has been shown by Lieutenant H. Hutchins, U.S.N., and others, the proposed electric substitute, the glow lamp, is but little, if any safer.

Efforts for the prevention of explosions have, therefore, followed various other lines. An early method was to explode small accumulations of the fire damp as they formed, a lighted candle, travelling on a cord, being sent into the collection. In Saxony efforts have been made to consume the gas as it issues from the coal, before an explosive mixture can form, but with very limited success. Other means, but each one defective in some essential, include (*a*) the occlusion of the issuing gas by palladium, thus securing a constant combustion without danger of explosion—Koerner's apparatus of red hot palladium asbestos being used; (*b*) the suction of the gas from the bed, as the mining advances, and its removal to the exterior by means of pipes and exhaust pumps; and (*c*) the saturation of the atmosphere with carbonic acid gas before making a blast, it being known that the presence of carbonic acid, in the proportion of seven to one, will neutralize the explosive tendency of the fire damp. But experience has demonstrated that, precautions being observed as to blasting, and safety lamps being used as special safeguards, the only convenient and trustworthy means for contending with explosive gas is thorough ventilation. This is, indeed, the chief factor of all efforts for rendering a mine generally secure as well as healthful, for in order that perfect ventilation may be maintained, the bank must be kept in good condition in all respects. As hitherto stated, the present tendency is to place coal dust on a parity with fire damp as an explosive element; but the precautionary measures are simpler than those which are necessary when the gas is present. The remedy is either to keep the roadways and working places sprinkled with water or salt, or, as proposed by Meissner, to saturate the solid coal with water before blasting, so that no dry dust may be formed. It is unnecessary here to elaborate the precautionary measures taken with reference to spontaneous fires, fragile roofs and floods of water.

It is not singular, in view of the many fatalities that yearly occur in mines, even where inspection laws are most stringent, and inspectors are numerous, that the layman should inquire: "Does State supervision protect after all?" An affirmative answer, well fortified with facts, may readily be given, but must here be stated only in brief fashion.

Since the work is based upon the maxim that to prevent is better than to cure, its utility cannot readily be perceived by the superficial observer. Frequently-recurring or great disasters are widely advertised, but we do not, nor could we well expect to, hear of the innumerable instances of budding disaster that have been prevented from maturing; nor, when disaster has come, do we learn to what extent State intervention had reduced the dangerous conditions, so that the event was confined to narrower limits than would otherwise have been the case. How many of the smaller accidents occur, which are in fact purely accidental, while relieving the high tension that would surely conduce to greater casualties, we have no means of knowing. But if we turn to the history of fatalities in countries and States where the inspection laws are good and the inspection force sufficient, we find a gratifying story. For England, the *Colliery Guardian* says: "The ratios of the fatal accidents and the deaths to the number of persons employed in and about mines, under the present and former Coal Mines Acts, show that the occupation of the miner is now more than twice as safe as it was at the commencement of the inspection." The average ratio for the first Act was one death for every 233 persons employed; for 1890 it was one death for every 530. In this country, Pennsylvania has in every respect the most comprehensive and the strongest law, and yet more fatal accidents are reported from that State than from any other section of the Union. Still the *Colliery Engineer* asserts that "there is no doubt that two tons of coal are mined now per life lost in the mines to one ton mined before the Mine Law was passed. In the region under the writer's immediate care, the fatalities have been reduced from one to every 330 persons employed underground in 1888, to one for every 405 in 1889 and one for every 604 in 1890.

Economy in Engines as Effected by Unbalanced and Leaky Valves.

One of the principal essentials of an economical engine is a tight valve, and one that will remain so for a reasonable length of time, and can be repaired at a minimum expense. The distribution of steam and the friction are also important factors, but the latter not to the extent generally supposed.

In an instance which recently occurred in the writer's practice, a cross-compound, having large unbalanced and riding cut-off valves, after running three years, was developing an indicated horse power on one and three-quarters pounds of coal per hour, while a new modern piston valve engine taking its supply of condensing water from the same source, and running under the same general conditions, used three and one-quarter pounds. By advocates of the piston valve, it is claimed that the unavoidable leakage past the valve, and many of them will not admit that such leakage exists, is a trivial affair and of minor account as compared with the friction; also that when packing rings are used the general effect is the same. This is hard to substantiate, and it is doubtful if ever proven in practice; and while it may be figured that the power required to overcome the friction is considerable, yet when the calculations are made from the coal used and the dollars and cents required to pay the difference, it will be found against the leakage and in favor of tight valves, even though their being and remaining tight is largely due to friction.

The power consumed in running an unbalanced slide valve on a small vertical engine was lately demonstrated in a way that was very surprising to the owners and even to the builders of the engine themselves. Word was sent to the builders that the engine had a broken valve stem and required a new one, but the surprising part of it was that the engine was running and continued to run until the new valve stem arrived ready to put into position. On arrival of the builders' men it was found that on the upward stroke of the valve the two broken ends coming together pushed the valve up at the proper time, and that the downward stroke was accomplished simply by the weight of the valve and that part of the stem remaining with it.

In a series of tests for one of the large electric companies, in which a large number of different types of engines and boilers were concerned, it was found that, outside of the Corliss, an unbalanced slide valve and riding cut-off engine required less steam than any of the others. This was a compound condensing engine, and the others with which it was compared were also compounded and condensing, using balanced valves. The general conditions were the same. In all the tests the runs were divided and the water used and power developed, as well as all the other conditions, were taken through the time of maximum and minimum loads separately, therefore, the comparisons could be easily and correctly made. These engines had been running but a few months and were considered by their builders to be in best possible condition. The best results obtained in a Corliss were from an engine which had been running for about two years without having the valves out or the cylinder heads off. With this engine the consumption of dry steam was 13.6 pounds per indicated horse power per hour, while another Corliss non-condensing engine, which should use less than thirty pounds, actually used 69.53 pounds per horse power, or 131.76 per cent. more steam than it should require, from the fact that the exhaust valves leaked this amount.

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Improvements in Drawing and Loading Coke.

By C. M. Percy, Mem. Inst. Mech. Eng., F.G.S.

A few days ago I received an invitation from Mr. A. M. Chambers to visit the works and collieries of Messrs. Newton, Chambers & Co., Limited, Thorncliffe, Sheffield, for the purpose of seeing in operation the patent apparatus of Messrs. Chambers and Smith for drawing and loading coke. Any improvement in mining or iron and steel manufacture or coke production is to me, and to everybody interested in these great industries, of great interest, and I gladly accepted the invitation.

The patents comprise "the patent coke extractor," and arrangements for "loading the coke from coke ovens into waggons."

The patent coke extractor consists of a small vertical steam engine actuating bevel gearing at the top of a vertical shaft, on which is a pinion working into a rack attached to a long iron bar which slides in a movable rest and is supported on rollers, and provided at the outer end with a shovel or inclined plate which is forced into the oven on the floor, under the coke. On the bar being withdrawn from the oven the coke is forced out by the back of the shovel. The shovel is pushed into and out of the oven as often as is necessary, or until nearly the whole of the coke is withdrawn. The rest on which the rack *and* bar slides, is movable by hand gearing, so that the bar and shovel can be directed at any angle, or into any part of the oven. By this means nearly the whole charge can be extracted, very little being left in the oven for removal by rakes.

The engine and gearing are mounted on wheels with self-acting travelling motion so that the extractor can be run upon rails in front of a row of ovens and be brought into position in front of any one of the ovens. A small vertical boiler mounted on wheels is coupled up to the extractor, so that the machine has its own independent steam supply.

The patent coke extractor can be applied to either bee-hive, square or rectangular ovens.

The rails on which the extractor runs are placed at a sufficient distance from the front of the ovens to allow of the coke from each oven being drawn out upon a travelling or endless belt fixed immediately below the oven mouths. The coke is thus conveyed to an inclined elevator which raises it to a suitable height. The coke on leaving the elevator buckets is put down gently upon a vibrating screen by means of a revolving drum with partitions exactly corresponding with the elevator buckets, and moving in the reverse direction, so that the coke is not allowed to fall, but the contents of each bucket are taken by the drum and placed upon the screen with the least possible amount of breakage.

In cases where it is not convenient to use the travelling belt, nearly equal results are obtained by drawing the coke into corves or small waggons running on rails close to the front of the ovens, and removed by a system of rope haulage to a small steam hoist, where they are raised to a suitable height and tipped into a screen or shoot.

The advantages obtained by the adoption of these appliances are as follows :—

(1.) By the use of the extractor a bee-hive oven containing three tons of coke can be drawn in less than ten minutes. One such machine is now actually drawing twenty-five ovens per day.

(2.) In consequence of the time saved in drawing the ovens, fully 20 per cent. more coke per oven per week is obtained, and this being so, the cost of the extractor and the whole of the extra plant required is saved by the lesser number of ovens necessary for a given output of coke.

(3.) Owing to the small time occupied in coke-drawing the expansion and contraction of the ovens is very much less, and consequently the charge for repairs is very much reduced.

(4.) An enormous reduction in the cost of working is effected. In a block of fifty bee-hive ovens now in operation the entire cost of coking, including the charging of the ovens, the drawing and loading of the coke, and repairs to ovens and machinery, does not exceed 6d. per ton. How much less this is than the cost of drawing and loading in the usual way, all coke makers will know. I offer no figures as to ordinary cost of drawing and loading in the old fashioned way. Coke makers need no figures, they already have them.

(5.) The whole of the coke from a range of ovens being loaded at one point can be under the supervision of one man, and greater cleanliness and regularity of loading is secured.

I spent a pleasant and instructive day in making a careful inspection of the whole of the appliances in actual operation. I saw an oven drawn in eight minutes and with scarcely any one in attendance. The coke is drawn and conveyed and screened and placed in waggons. I was not surprised that the apparatus is being applied throughout the extensive coke making appliances of Messrs. Newton, Chambers & Co., Limited, nor was I surprised to hear that other eminent coke producers in various parts of the United Kingdom had adopted and were adopting the apparatus. I shall be very much surprised if all our coke makers do not speedily give their attention to so simple and efficient and cost-reducing an apparatus with a view to its general adoption.

Certainly I know of no arrangement in coke manufacture in ordinary ovens which does the work so well and at so little cost.—*Colliery Guardian.*

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MINING NOTES.

[From Our Own Correspondents.]

Nova Scotia.

Cumberland County.

The production for 1891 of the Springhill Collieries, owned and operated by the Cumberland Railway and Coal Company, will show a considerable increase over last year. The total output for 1890 was 419,012 tons ; for 1891 it will probably be 459,000 tons, an increase of 40,000 gross tons. From the following statement of the monthly production of the colleries, it will be seen that there was a falling off in the output during February and March, caused by the disastrous explosion on Feb. 21st :

January....	44,889 tons.	July	33,718 tons.
February...	28,816 "	August...	40,986 "
March.....	29,883 "	Septemb'r	36,368 "
April......	40,716 "	October..	41,687 "
May.......	38,788 "	November	39,000 "
June.......	39,976 "	Dec. (est.)	43,500 "
			458,277

The sales for the year from these collieries will aggregate 405,000 tons—an excellent showing.

As pointed out in the last issue of the Review, there is great activity among the prospectors of Cumberland County. Those who made money out of the lucky discoveries at Springhill twenty years ago are spending their money freely in search for coal in other parts of the county. This is notably true of the Stanley Coal Co., of Amherst.

After January 1st, 1892, the employees at all the collieries are to be paid fortnightly. The new Act relating to the fortnightly payment of wages was passed at the last session of the Legislature. Heretofore there has been a system of semi-monthly payments at Springhill, and the Drummond Colliery in Pictou. The system was given a trial by the Acadia Coal Co., but abandoned with the consent of their workmen.

The Review learns that it is the intention of the Local Government to at once appoint a number of examiners of engine drivers employed at the different collieries. A board of examiners of miners, to whom certificates of competency or service must be issued at the beginning of next year, must be appointed soon.

At the Joggins Colliery, operated by the Canada Coal Co., under the efficient management of Mr. James Baird, long-wall working continues to prove successful ; it has greatly reduced the cost of production, and largely increased the output per man over the bord-and-pillar system. Other changes have lately been made. Formerly the coal was sent to the water over a track 1⅛ miles long, operated by an endless cable ; this required a rope over 11,000 feet long, and was a source of great trouble on account of its liability to get out of order. The coal is now sent from pits to water by gravity, and the empty cars are brought back by single rope attached to drum on stationary engine at pits. Previously the coal, on arriving at the water, was emptied into a chute 120 feet long, lying at an angle of about 23° ; this chute was provided with doors for the purpose of easing the coal down the vessel, but the compact of the coal with the doors had a tendency to break the coal and the vessel get a large per centage of slack, no matter how carefully the coal was handled. This chute has been taken out and an incline built to the wharf, over which the coal is now lowered to wharf by a counterbalance and then emptied into a chute with but very little drop, thus doing away with the large amount of breakage, and allowing the vessel to turn out a much better grade of coal at her port of discharge. The loading wharf has been reconstructed, and now vessels drawing from 15 to 17 feet of water can be loaded with dispatch. The Government improvements to the breakwater have proved beneficial ; it now affords a greater protection to the vessels. From 250 to 300 men and boys are employed by the company.

GOLD MINING SUPPLIES.

The principal depot in Nova Scotia, carrying the most complete assortment of first-class goods, is

H. H. FULLER & CO.'S

41 to 45 Upper Water St., Halifax, N.S.

Our line comprises Explosives, Fuse, American and English Mill and Hammer Steel, Bar and Bolt Iron, Steel Wire Hoisting Rope, Hemp and Manilla Rope, Rubber and Leather Belting, Miners' Candles, Oils and Lamps, Miners' Tools, Machinists' Tools, Blacksmiths Tools, and every requisite for the gold miner.

H. H. FULLER & CO.,
Halifax, N.S.

Mr. Hugh Fletcher, of the Geological Survey staff, has completed an examination of the Parrsboro' shore. He left for Londonderry to carry on some explorations in the Cobequid Mountains.

William Madden, Deputy Inspector of Mines, has, it is stated, resigned to accept the position of manager of a gold mine in Guysboro' County, in which he is interested.

At the time of the Springhill explosion the school children of Cumberland County raised a little fund of their own. At the suggestion of Inspector Lay they expended the money on two gold medals, which were suitably inscribed, and presented to Daniel Robertson and Daniel Beaton, the boy heroes of the disaster. It will be remembered that Beaton saved the life of his brother, who was badly injured ; and Robertson rescued a little trapper named Farris. Robertson was badly burned, and his face is disfigured probably for life. His head was seriously burned, and there are spots on which the hair has not yet grown. He is now attending school. Both boys are about fifteen years old.

Cape Breton.

The East Bay Coal Company has been formed to develop coal lands in Cape Breton. The company has acquired the mining rights to a tract containing ten square miles of land, situated within two miles of East Bay, being the eastern end of the Great Bras D'Or Lake. The company has here forty feet of water and a water way leading to the Atlantic ocean and the St. Lawrence river. The mine is situated so that a gravity tramway will carry coal to the ore chutes, one and a half miles from the present shaft now being sunk. The development work done so far is a shaft about 100 feet deep, which was sunk in coal all the way. At a depth of 50 feet, a cross-cut of 15 feet each way was made without touching the walls. The coal improves in value about ten per cent. to each 20 feet sunk. A blacksmith shop has been built, a hoist rigged and a pumping plant put in. A new shaft is soon to be sunk on the widest vein about two miles from the present workings. The work is in the charge of Mr. Wm. N. Young, an experienced miner, whose reports are extremely flattering to the present stockholders. It is expected to begin the shipment of coal on or about the first of July next. The officers of the company are Ashley W. Cole, president ; W. H. Clarkson, vice-president and W. A. Powell, treasurer.

Mr. H. N. Paint, on behalf of the incorporators, gives notice of an application to Parliament at next session, for an act to incorporate a company to build, equip, maintain and operate a line of railway in the Island of Cape Breton, Province of Nova Scotia, connecting with the present Dominion railway now under construction in said island, from a point known as Orangedale, in the County of Inverness, touching Whycocomah, on the Broad Cove Coal Mines, a distance of 34 miles ; from thence to Margaree, 20 miles ; from thence to Cheticamp, also to Baddeck, Victoria County, 35 miles, all in Inverness and Victoria Counties. Also for a line of railway from a point known as the Richmond Coal Mines, there joining the present Cape Breton Railway, proceeding via St, Peter's to Louisburg, 78 miles ; with power to acquire coal mines or any railway companies.

Colchester County.

The *Halifax Chronicle* reports the discovery of a three-foot seam of coal a short distance from Truro, in Colchester County. A quantity of the coal has been mined and sold. A number of Truro capitalists are interested.

Hants County.

Your correspondent, in conversation with Mr. George Churchill, head of the ship-owning firm of E. Churchill & Sons, of Hantsport, learned that the Messrs. Churchill are preparing to develop their valuable manganese mine at Walton, in Hants County. Mr. Churchill has refused a large sum for the property. Hitherto it has not been worked except on a small scale, but $8,000 worth of manganese has been mined and exported, and it is likely the production next year will be large. The manganese is found in pockets, but the extent of the deposits has never been tested.

Stormont.

Considerable excitement prevails in Isaac's Harbor over the discovery of a valuable lode of gold-bearing quartz in the "Skunk's Den," which is a small valley lying to the eastward of the main district. The lode has been opened in four different places and is reported to show gold in each opening.

The reported find of a lode in Seal Harbor appears to be without foundation, the find consisting of a belt of slate more or less interlaced with quartz, which, however, shows no gold. The North Star Co. report all their workings in good ore and prospects good for its continuation.

Molega.

On the 1st of November the Parker-Douglas Co. closed down its mines for an indefinite period. It is reported that October's crushing showed a small profit, and that the mine will reopen; but this report lacks authenticity. This mine has been extensively equipped with air compressor, drills and hoisting gear, and also has a 20-stamp mill; but the public generally will be surprised to learn that no depth has been reached, although the mine has been working more than three years. The average depth of the workings will not exceed 100 feet.

Montague.

With the exception of the Annand Mine, no work is doing in this district. A few tributers are working spasmodically. The Annand mine continues its usual good yield.

Waverley.

The Lake View Co. is running regularly, and the quartz is reported to be higher in grade than formerly.

Nothing is doing in the Windsor Junction Mine, but tests are being made of the surface gravel by crushings in the mill, and experiments are to be made with a new percussion table on the large pile of tailings lying on the mill dump.

The West Waverley Co. started fires under the new boiler plant on the 19th ult.

The Sophia Co. have gone back to their first line, and are again opening on the "Nigger" lode. Some quartz is being stoped on the Tudor also.

Mount Uniacke.

The Alton Co. have temporarily discontinued work, it being found that the recent rich strike dips off to adjacent property very rapidly. A consolidation will probably follow.

Pictou County.

Work on the iron areas owned by the Pictou Charcoal Iron Co., has been actively commenced. An office, blacksmith's and carpenter's shops have been erected, and road graded 1,400 feet to connect with New Glasgow & Midland Railway. Ore will be mined and some 7,000 cords of wood got out this winter for charcoal, and such work done as can be advantageously performed in the winter.

Mr. W. B. Moore, formerly superintendent of the Vale Colliery, is in charge, assisted by Mr. Sjostedt, a thorough "iron man," formerly chemist to the Bethlehem Steel Co., of Pennsylvania, and afterwards manager of iron mines in Alabama and Virginia. The company hopes to have a furnace of a capacity of 25 tons per day in full blast by the 1st of July.

Quebec.

Eastern Townships.

The Eustis and Albert Mines at Capelton pursue the even tenor of their way. The other mines and quarries at work include the Howard pyrites property, the Jeffrey Asbestos Quarry, the New Rockland Slate Co. and the Stanstead and Moir Granite Companies. We are glad to learn that the large number of men thrown out of work by the closing of the asbestos mines are finding work for the winter in the lumber camps.

Mr. J. Obaski, M.E., Government Inspector of Mines, Quebec, will read a paper at the next meeting of the Asbestos Club.

Lievres River.

The High Rock Mines have reduced their working force to 50 men for the winter.

From 80 to 100 tons per week is reported to be the average product of the High Falls phosphate property, operated under contract for the General Phosphate Corporation by Mr. George Stewart and a good force. Mr. Stewart has secured an extension of ttme and an important increase in working capital with which he hopes to fulfil his agreement with the corporation.

The only other property at work in this district is that owned by the Anglo-Continental Guano Works Company. Since the announcement of the verdict in the law suit with the Emerald Company the working force has been greatly increased and work is now being prosecuted vigorously. Mr. Smith is at present driving the Aetna, and Squaw Hill tunnels, and reports the work proceeding to his entire satisfaction.

Ontario.

The Provincial Natural Gas and Fuel Co., of Ontario, have made some new developments in their gas field. About a month ago they struck oil. The well was opened last Monday, and at present averages about twenty barrels a day. The oil flows and is of fine quality and amber in color. Manager Coste says it is a regular Pennsylvania oil. The field is in the County of Welland.

There is, say local papers, considerable excitement in mining circles in regard to the Belmont gold mines, some miles north-west of the Marmora. The ore taken out is reported rich in gold, giving good encouragement to the owners. An English syndicate have the mine in hand. Forty miners are now at work and a shaft has been sunk to a depth of over 60 feet. The ore now taken out, it is claimed, is panning out $18 to the ton. Expensive crushing and reducing machinery has been imported from Englnad and a large outlay of money is being made. These mines are not many miles from the "El Dorado" and other gold mines near Marmora, from which gold has been taken for many years but never in good paying quantities.

For the nine months ending 30th September next, the export of mica from Kingston to the United States was of the value of $4,550. The Sydenham Mica Co. and the agent of the Thomson-Houston Co. are the only operators for export. Rough amber mica is raised in considerable quantity by farmers and sold to the cutting concerns at prices ranging from $25 to $100 a ton. A car load of crude material was recently sold to a hardware house in Kingston. Recent discoveries in Bedford and Hinchinbrooke Townships extend the producing area, which has been hitherto confined to the Township of Loughborough. The white mica region in Miller, Palmerston and Clarendon sends in occasional samples of asbestos with actinolite, but no exploration has yet been made to show what these indications signify. It is said that a hawk lights down on every prospect hole, crying large sums of money—$10,000, $20,000 and "Stuffing 's good for geese," and with the inevitable result that all reasonable birds are frightened away by these outrageous cries.

Sudbury District.

The ocean shipments of nickel ore and matte from the port of Montreal for the season of navigation just closed, amounted to a little over 885 tons. This is a portion of the produce of the mines of this district.

Thunder Bay District.

Just as we go to press it is announced that the Belgian Bank, known as the Society General, has purchased a controlling interest in the Atikokan Iron Range. The contract provides that the purchasers shall have until November next year to test the deposits. The railway is to be built within the next year, and when so built the owners deed the bank an interest in the mines, and the bank agrees to mine the ore and pay a royalty thereon. A minimum output of 300,000 tons per annum is guaranteed. The lands under contract cover ten miles in length on the range, including deposits of ore equal to all the mines on the Marquette range. Blast furnaces and rolling mills are, under the contract, to be erected at Port Arthur. We hope to have full particulars of this deal in our next issue.

D. Williams, P.L.S., returning from a tour of exploration, reports having taken up three mining locations in the Township of Moss containing a large deposit of magnetic iron ore. He has also taken up six locations west of the Mattawin Iron Mining Co.'s property, the ore on which is a hard slate hematite, averaging 50 per cent. of metallic iron. In the same region Mr. Williams has discovered carbonate iron ore (siderite) in considerable quantity.

The Palisades Mine, which is situated north of the "Beaver," is working in some rich silver ore, with brilliant prospects ahead. The mine has for some time been under the direction of Mr. Winchell, son of the State Geologist of Minnesota.

A find of rich auriferous quartz is reported from Wahigoon Lake.

The Murillo Silver Mine, owned by an English syndicate, is now advertized for sale, together with the frame buildings thereon: boarding house, assay office, engine house, etc. Also the plant, consisting of a double cylinder, 8 x 8, Copeland & Bacon winding engine; a 60-h.p. boiler, smaller boiler, 2 duplex mining pumps, pipes, fittings, 400 feet of ⅞ steel, mining implements, stoves, full set of assayer's implements' etc., etc. Offers to be made to Mr. Richard Winder, secretary of the Murillo Silver Mine (Ltd.), 7 East India Avenue, London, Eng., from whom full particulars may be obtained.

Rat Portage District.

There has been continual trouble in connection with the reduction works at Rat Portage ever since the enterprise was begun. The latest is the trouble between the manager and the company. Mr. Powers lays claim to 23 months' work, at $100 per month, but the officers of the company say that they know nothing about his claim, as it has never been presented, and that the company is certainly good for any service performed for it. Mr. Linn, the contractor, tried upon two occasions to hand the works over to the company, but Mr. Powers objected. Mr. Powers being interested in the erection and completion of the building, did not see fit to allow Mr. Linn possession to enable him to give up possession to the company. On Wednesday evening last week Mr. Linn went to the reduction works, put the watchman out of the building and off the premises, and handed the works over to the committee appointed to receive it. For this he was arrested and fined in all $12.50.

In speaking of this matter the Rat Portage *Herald* says: "The works are now in the hands of the company and work will be begun at once. A new man, from California, who is thoroughly acquainted with the treatment and reduction of ores, will be employed. The resignation of Mr. Powers, tendered to the company some weeks ago was accepted, so that unless new arrangements are entered into he will no longer be a representative of the company. We learn that the services of Mr. Powers for the company were to begin when the works were turned over and the mill started, and his salary to date from such time. The contractor, Mr. Linn, could not make any settlement with the company until its acceptance and occupancy of the mill; and it is wondered why Mr. Powers should object to the very thing necessary to make the contract complete and enable the company to run the mill. Ore has been on the dock for some days and nothing done. The directors were inclined to push matters, and hence the circus. Unless the opposing factions prevent and annoy too much, the works will be started up this morning. Mr. Linn has brought in his men from L'Divir Mine, and each will take a station in the mill, and it will be run under his direction and supervision until the metallurgist arrives from the States. It is hoped that all will pass off smoothly now. The president is bound to push matters, and if he can have his way things will move along lively. Other directors of the company are expected here soon."

British Columbia.

Thomas Harvey, one of the old time prospectors of Cassiar, returned from the north on the steamer Mexico, after an eventful prospecting trip through the most northern portion of the province. Cobbet Creek, he says, is one of the best camps in the portion of the country where he has been, but even there there has been no important find. Seven white men and fifteen Chinese will remain there during the winter. From reports nothing startling has occurred on McDame's Creek during the season; in fact about the same amount of gold has been taken out this year as formerly. The miners have to do well, as provisions are very dear, salmon being sold at 75 cents a tin, and other provisions in proportion. What is wanted is more settlers and roads or trails. The country, said Mr. Harvey, is a rich one, and the Government should open it up. About 100 miners came down from Yukon on the Mexico with Mr. Harvey, and he learned from them that they were also suffering for want of roads and trails to take them to the mines. Some of them had made $300 to $400 during the three weeks that they worked. The shortest way to get to the Yukon mines would be by the way of Devon Creek and Pillar River. A road cut from Devon Creek to Pillar River, a short distance, would do a great deal of good. The miners could then go down Pillar River in canoes.—*Victoria Times.*

There is little of importance to chronicle regarding mining in Hot Springs district. Eight men are at work on the Skyline, 5 on the Neosho, 4 on the Fourth, and 13 on the Tenderfoot. Manager Jevons has all the hoisting machinery for the latter mine on the ground, getting the last piece up to-day. There is from a foot to a foot and a-half of snow on the flat at the Krao, and about two feet at the Skyline. Dr. Campbell claims that work will soon be resumed on the Number One.

Superintendent Robertson reports the main tunnel on the Grizzly Bear in about 180 feet, with two shifts at work. One shift is also at work in the shaft, cross-cutting for the ledge. The cross-cut is in 12 feet, and it is expected that 20 feet more will have to be run. Superintendent Ray expects that the cross-cut tunnel on the Dandy will reach the main or south ledge by the end of the coming week. If that ledge is as good as is expected the Dandy Mining Company will have 500 men on its pay-roll before another year rolls around.

The mine owners in East and West Kootenai district are, we believe, to a man, in favor of the Dominion Government increasing the duty on pig lead from $8 to $30 a ton.

The Lanark Mining Company at Illecillewaet is engaged in packing in supplies to its mine; it will keep two shifts working all winter. This will keep the property in good shape; and when the tramway is completed in the the spring it is expected that 40 tons of ore per day will be shipped.

The wire tramway of the Glen Iron Mine Company has not so far been a success. The company is now opening a new lode and is about to build an ore shute and bunkers. It has about 600 tons of ore ready for shipment.

The owners of the collier San Pedro, have made a claim on Messrs. Dunsmuir for $20,000 as salvage money for assistance rendered to the steamer Wellington a few weeks ago, when she was picked up disabled and towed into port.

Although the coal trade is not brisk the New Vancouver Coal Company is not decreasing its activity. At No. 5, the new shaft, three shifts have been put on for the express purpose of opening up rooms for the employment of a large number of men when the demand requires it.

A sample taken from four tons of ore taken out in the stoping on the Le Roi, a trail Creek claim, gave $60.30 in gold, $2.10 in silver, and 6 per cent. of copper, or about $77.40 per ton.

In an interview with a local paper, Mr. J. D. Marsden, of Barkerville, who came to the coast about a fortnight ago, taking to Victoria two bars of gold, valued at about $6,000, for deposit in the bank there, said: "There has been no remarkable incidents in mining during the past summer. Some of the claims are showing good results. The Black Jack mine has had a successful summer, and the Forest-Rose Hydraulic has maintained its former profitable yield. The Waverley, a noted hydraulic claim on which about $10,000 has been spent in development, is this year looking better and prospects are good for a profitable season next year. In quartz mining considerable development work has been done on the Eureka, on Mosquito Creek, and another claim on Williams' Creek has been bonded to an English firm through Mr. A. D. Whittier, of Victoria, who recently made a trip to England. The other claims show little difference one way or the other from last year, and have been worked with more or less success.

The Lillooet Hydraulic Mining company cleaned up on the 25th ulto. The clean up was about $2,000 for twenty-four days with five men.

The Great North American placer claim is working three men with rockers at present. The water supply is almost exhausted. The claim pays $3 per day to the man.

The Scum Scum Mining company, located on the South Fork of Bridge River, are getting out timber to repair their dam which was washed out about one month ago.

The Kootenay Smelting and Trading Syndicate is leaving nothing to chance in the erection of its reduction plant at Pilot Bay. The site has been carefully surveyed and accurate soundings made for the wharves. The plans for the buildings were not made until the ground was first carefully examined by a representative of the firm furnishing the machinery. The bricks needed will be made near the site, the brick machines being already on the ground. It is understood that the Chicago Iron Works has secured the contract for furnishing the plant. This is the same firm that erected the Poorman 10-stamp mill on Eagle Creek.

The Mina Placer Company, located on Taughton Creek, a tributary of Bridge River, have shut down for the winter. They expended over $2,000 on their claim this Fall, but it will take about $1,000 more to get their claim in working order. The Mina company value their property at $90,000.

The shipments of coal from the collieries for tbe month of November, were:—

		Tons.
New Vancouver Coal Co		15,809
Wellington	"	21,243
East Wellington	"	2,520
Union	"	17,080

The boring for coal on the Harewood Estate, now the property of the New Vancouver Coal company, has been carried on very successfully; the indications have been so good that a shaft is being sunk. The necessary engine and machinery have been sent out to the district. It is believed that Harewood will turn out to be as rich a coal field as Wellington.

The same company has sunk a shaft at the south end of Protection Island, to a depth of 585 feet and expects to reach the coal layers by Christmas. At the depth named, when in a stratum of conglomerate, the sinkers struck soft black sandstone, in which were imbedded some beautiful specimens of clam shells. The coal is expected to be reached at a depth of 620 feet.

An English syndicate, whose purchase of the rights along Williams' Creek, in the Cariboo District, has already been recorded, will, as soon as the formalities are completed, commence shipping in and placing in position the elaborate machinery required to profitably work the property. The Syndicate's rights extend down Williams' Creek, through the canyon, from below the old town of Richfield, past Barkerville, to Ballarat, a distance of a mile and a half or two miles. The machinery to be brought into service is similar to that in successful use in California, its great superiority being that a strong flow of water is not required to complete the process. For this reason other machinery would be useless in working the shallow creek and the marshes in which it terminates. The field of operations of the company takes in all the famous old claims on the creek, which is known to still have millions in gold hidden in its sands.

Another company, whose operations promise well, is that of which Mr. Ramus is manager, and which has been formed to prospect and work Slough Creek. The machinery has been received, and the examination of the creek will be commenced very shortly; the stream is so deep that with ordinary appliances nothing could be done with it. Mr. Ramus' idea is to drill through the water to the bed, much after the same fashion as one would drill for coal or other minerals on land. If the experiment proves successful, many other creeks will be available for working by the same process.

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CANADIAN COMPANIES.

Coleraine Mining Company.—This company was granted its charter on 20th ulto.

Dunnville Natural Gas Company, (Ltd.)—Application for grant of supplementary letters patent for increasing capital stock from $5,000 to $20,000, by the issue of 600 new shares of a valve of $25 each.

General Phosphate Corporation.—The first annual meeting of the shareholders of this company since its incorporation, will be held in London, Eng., on the 22nd of this month. A lively time is expected.

Boiler Inspection and Insurance Company of Canada.—This Company will apply to the next session of the Parliament of Canada, for an Act to add to the powers of the company the right to insure against loss of humane life or injury to person or property arising from the use of elevators, hoists or lifts or machinery connected therewith, and machinery used for the production of electricity as a motive power or illuminating agent, and otherwise enlargeing the character of the risks which the company may undertake, and for such other powers as may be necessary in the premises.

Spokane and Great Northern Mining Company.—Articles incorporating this company have been filed in the auditor's office at Spokane, Washington. The company is organized to develop and work mines and prospects in British Columbia and elsewhere. The capital stock of the company is divided into 2,000,000 shares of $1 each. The incorporators are Chester F. Lee, H. M. Hoyt, Arthur B. Keeler, and Howard C. Walters. It is to be hoped the new company will spend money for other development work than printing certificates of stock.

General Mining Association (Limited).—A special meeting of the proprietors took place last month at the head office of the company, in London, to hear a statement concerning the affairs of the company and to elect a director in the place of Mr. C. Bischoff, resigned. Lieut.-Colonel W. C. Western presided, and previous to moving a resolution to the effect that Sir Charles Tupper be elected to fill the vacant post, stated that the work at the mines was going on satisfactorily. They had a good supply of labor, and the telegraphic despatches showed that the shipments continued on a fair rate. The prices and sales of their coal had up to the present been better than in 1890, and the outlook was altogether very favorable. Mr. Clark seconded the chairman's motion, and it was at once unanimously adopted. The proceedings then closed with the according of the usual vote of thanks to the chairman.

New Vancouver Coal Mining and Land Company (Limited).—A half-yearly general meeting of the above company was held at the office, 12 Old Jewry Chambers, London, E.C., on Tuesday, 17th ultimo, Mr. John Galsworthy occupying the chair. The secretary, Mr. Joseph Ramsden, having read the notice convening the meeting, the chairman rose to move the adoption of the report and accounts, first apologizing for the absence of Mr. Fry. He considered the report and accounts were eminently satisfactory, and that the operations of the past half year showed the company was in a fairly prosperous state. The output for that period had amounted to 253,296 tons, and the sales to 254,025, against 217,338 tons, and 215,000 sales in the previous half year. That was a very large increase, in fact it was the biggest output since the establishment of the company. This output had been derived from five sources detailed in the report. The great amount of work carried out during the past half year had over-taxed the strength of the company's superintendent, Mr. Robins, and that gentlemen had taken a short rest at San Francisco to recruit himself. Everything done augured well for the future of the company. The chairman did not hesitate to say that the balance sheet was the best ever submitted to the shareholders, and was now in a better state than it had ever been. As for the dividend, some shareholders considered it should have been larger. It was a small dividend, undoubtedly, but looking at the works carried out, and the fact that the working capital of the company had never been what it ought to have been, he did not see how the directors prudently could declare a higher. It was better they should increase the reserves, and thus provide a good working capital, than pay a high dividend and be obliged to borrow money at a great rate of interest, without considering the fact that the coming half year could not be so prosperous as the past, owing to the fall in prices at San Francisco. Mr. F. Tendron seconded the motion for the adoption of the report and accounts, and expressed the opinion that it would be prudent for the company to have a good working capital at its back. (Applause). The motion was carried unanimausly. Hearty votes of thanks to Mr. Robins, the company's superintendent; to the agents, Messrs. John Rosenfeld's Sons; and to the chairman and directors, concluded the proceedings.

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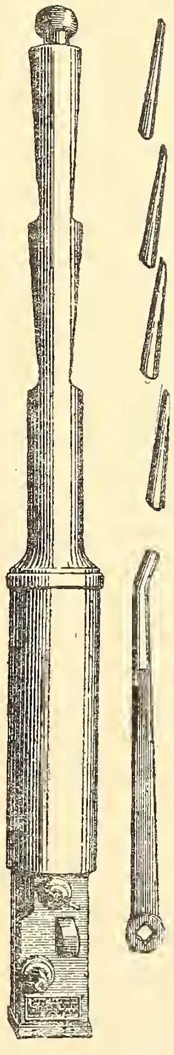
Improved Mechanical Coal-Getter.

In a paper read before a recent meeting of the National Association of Colliery Managers, Mr. E. Mould, of the Whiteburn Colliery, said:

It is with considerable pleasure that I accept the invitation to read a paper in the presence of the members of this branch on the principles and purposes of my improved hydraulic coal-getter. But I must confess that I feel rather diffident in the matter, from the consciousness of my inability to lay my invention before you with that accuracy which a subject of this description demands. I feel, however, somewhat relieved when I remember that many of you have seen my coal-getter at work, and have spoken of its merits with approval.

Dust of itself is harmless as regards exploding. There must be something else. This being so, is it not a loss of time to aim at many things and miss the evil itself, especially when that evil can be avoided by a process that is positively safe and efficient. We all know it is very important that any new method should be thoroughly considered in all its bearings before it is adopted, as it is very possible, especially in colliery management, that the change may be for the worse.



It has already been shown that to lay down water pipes and keep them in working condition is an expensive operation. The water emitted in the form of spray has an objectionable effect on the surroundings, especially in goaf roads, where all the coal has been extracted, and the travelling roads consist of material some of the constituents of which are lime or fire-clay. The timbers of these roadways absorb the moisture, which, as a member of this Association has said, "renders them unfit for the purpose for which they are intended, for if the timbers are not good and well set they become traps and snares." Referring to the water cart, with all its accessories in the form of pumps and brushes, and the cost of transit in our steep mines, is it not very objectionable?

There is a great disadvantage in connection with shot-firing, in the continual cost. And this is not all. By the use of explosives we are constantly producing a more serious evil in dust. The force of the explosive shatters the coals into almost useless material.[*] I am fully satisfied in my own mind that I have seen more than one explosion by shot-firing when the largest piece that could be found was not as big as a man's hand. The substitute for explosives does its work in a harmless manner, and is efficient in its action, breaking loose the coals in larger blocks, and so lessening the quantity of that dangerous enemy, dust. Our engineers have been conscious of the existence of this deadly foe for a long time, but have avoided dictating to othes rtheir own convictions. I remember when the late Orlando L. Lucas read a paper (Dec. 25th, 1877) on "The Destructive Results of the Use of Gunpowder in our Mines," one of our senior engineers gave an instance that resulted fatally, and at the inquest he was actually "pooh-poohed" when he mentioned the possibility of the cause being coal-dust. Nevertheless, facts are facts, whether they be accepted or rejected.

I would now ask, is it not time that colliery managers and colliery owners, especially the former, who are held responsible for the safe working of the mines, should take their stand, and say (as one of our colliery owners, Wm. Heath, Esq., of Sneyd Colliery, said in reference to a dusty seam, years ago), "There shall be no more shot-firing on any account in a place where dust can be found"? In the course of time—it may be very shortly—this will be considered a step in the right direction, though there may be opposition, as there has been in the case of nearly every innovation.

Permit me to suggest, that from this time we discard the idea of either laying down pipes or adopting the water-cart, or any similar means of laying dust, and adopt a safe method of working without further hesitation. The method I suggest would render any such system of watering unnecessary. Most of you are aware that I have been working, indeed, persistently endeavoring, for a long time to bring out a mechanical contrivance that would take the place of explosives in dusty and fiery mines, and during that period I have produced designs of almost every description, screws of almost every kind, and hydraulic appliances of various forms. I have had many disappointments, but after them all I can now, with an instrument a little over 60 pounds in weight, break loose, economically and efficiently, almost any coals in the ordinary way of working. This instrument may be used as an ordinary hydraulic jack for any lifting purposes up to ten tons. It may also be used to considerable advantage in renewing timbers in roadways. Hence, if you have a broken stoop or leg, by placing the "coal-getter" under the crossbar or cap, you can, in most cases, force it up high enough to put in a fresh leg or stoop, thus preventing the fall of tons of dirt. Or if there should be a broken bar, place a strong sleeper by the side of it, and the "getter" under it; you can then force up the brailers or covering, and so renew the broken bar or cap, thus saving a great amount of labor, as well as much time. I will now endeavor to give you a description of my hydraulic coal-getter: 1st, there is what I call the head; 2nd, the cylinder; 3rd, the mandrel; 4th, the piston-rod, the side-pieces and the pump-handle.

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[*] Professor Clowes as reported in *The Colliery Manager* for 15th May, 1891.

The side-pieces and the pump-handle are the only loose parts there are.

The "head" contains the pump, and in part answers the purpose of a reservoir.

The "cylinder" is simply a round, parallel barrel, screw-threaded at each end, and is so connected to the "head" at the top end and to the "mandrel" at the bottom end. This cylinder is covered by a shell cylinder, leaving a cavity between the two—the inner and outer cylinders.

The inner cylinder is perforated on the sides at the bottom end, to allow the water to pass from the under side of the piston, while it is being forced into the cylinder on the top side of the piston by means of the pump, thus supplying the pump during the operation of breaking loose the material in which it has been placed. I have already said that the inner cylinder was screw-threaded at each end. Now, while it is being screwed together the outer shell is drawn on to faced joints at both top and bottom ends, and is so made water-tight and becomes a portion of the reservoir for water.

Thus you will understand there is ample provision in the head, the cylinder and the cavity. This is to avoid the necessity of continually refilling with water, which may be more or less unclean.

The mandrel is screwed into the bottom end of the cylinder, and so becomes a permanent joint. The mandrel is also provided with recesses, constituting incline planes. In these incline planes are placed side pieces or wedges, thus making the mandrel cylindrical in form, in which condition it is placed in the hole prepared for it.

I have said there is a cylinder and a piston; there is also a piston-rod. This rod passes from the piston in the cylinder through the mandrel, and on the bottom end there is placed a collaring, so as to enlarge the bearing, because this becomes the base of pressure.

It is very important that the machine should go quite to the far end of the hole (and to ensure this the drill should always be one eighth of an inch larger in diameter than the machine). Now, supposing the machine is in the hole, and quite at the far end, the moment you commence to pump, the piston rod, being at the end of the hole, cannot go forward; therefore the machine moves outward, and, the friction on the sides of the hole being greater than that of the incline planes, the side pieces become fixed, and the machine moving outward produces lateral pressure by means of the incline planes, thus forcing asunder the material in much larger blocks than when exposed to the shattering influence of an explosive, securing better results, and at the same time avoiding all the evils contingent on the use of explosives.

This machine has been severely tested, and, as a result of these trials, I claim the following for it. The merits of this machine are:—

1. Efficiency.
2. Portability.—Being a little over 60 lbs. when charged with water, the same water is used over and over again, it may be for months, so that you see the pump is intact; and this is accomplished by means of a screw. When the operation is completed, by turning the screw the water returns to the under side of the piston. By tightening the screw again you can repeat operations indefinitely.
3. Economy.—Being less in first cost, and less liable to get out of repair, its parts, or loose parts, being so few in number, consisting only of side pieces and pump handle.
4. Simplicity.—Place the side pieces in the recesses of the mandrel, force it to the far end of the hole. If you want to lift the coals up or force them down, the side pieces must be top and bottom; but if you want to force the coals side ways, the side pieces must be right and left. Then commence pumping, and in less time than you can ram the hole for an explosive, the coals will be down or on the spraggs, ready for dropping as you want them.

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An Expert Opinion on Electricity in Mining.—"It is only a matter of time until electricity will revolutionize the mining industry," said F. M. Carpenter, of Devil's Run, Nev., in the Chicago *Herald*. "By conveying water in flumes to the mouth of a shaft on the Comstock, and then letting it fall to the level of the Sutro Tunnel, a force equal to a pressure of 680 pounds to the square inch was generated; the problem was, how to transfer this power from the tunnel level, where it was not wanted, to the stamp mills, where it could take the place of steam. The problem appears to have been solved by the use of electricity. Electric motors convey the power with a loss of less than 40 per cent. from a point 1,600 feet below the surface of the ground to the mill on the surface, and when the power reaches the stamps it is found to be equivalent to 435 horse power, which would run any stamp mill in the world. With steam as a motive power it is impossible on the Comstock. even with the latest improvements in reduction, to treat economically ore which carries less than $15 of gold and silver to the ton. Where the ore lies on the surface and can be quarried out in enormous quantities, as in the Black Hills in Dakota, there is money in mining and milling ore which runs a few dollars to the ton. But where the ore has to be hoisted from great depths and considerable expense has to be incurred for pumping, ventilation, crushing, etc., the cost of steam is so great that really low grade ore cannot be handled at a profit. If the new electric motors prove successful in practical use, this cost will be saved. It is estimated that with the power furnished by them the Nevada mill can treat $10 ore satisfactorily, and with an ample water supply even $5 ore can be treated with profit."

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PERSONAL.

Mr. J. G. S. Hudson, manager of the International Colliery at Bridgeport, has accepted a similar position at the Gowrie Colliery, Cow Bay, owned by the Messrs. Archibald. Mr. Hudsou comes from Bridgeport in high esteem and with the best wishes of many friends and his late employers.

Mr Charles Fergie, M.E., manager of the Drummond Colliery, has returned from his trip east.

Messrs. H. A. Budden, managing director of the Intercolonial Coal Co., and Mr. Chas. Fergie, M.E., were in Sherbrooke during the month, conferring with the Jenckes Machine Co. respecting further improvements to their large new winding engine.

Mr. J. George Rutherford, jr., assistant manager of the Acadia Coal Company, Stellarton, N.S., is at present in

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GENERAL
MINING ASSOCIATION
OF THE
PROVINCE OF QUEBEC.

The Second Annual General Meeting of this Association will be held in the New Club Room, Windsor Hotel, Montreal,

ON

WEDNESDAY, 13TH JANUARY, 1892.

THE FOLLOWING IS THE PROGRAMME OF PROCEEDINGS:

MORNING SESSION.

(Commencing at 11 a.m.)

Report of Council and Financial Statement for the year; Report of the Dominion Government on the petition to disallow the Quebec Mining Act; Amendments to Constitution and By-Laws; Election of Officers and Council, 1892, and other business.

AFTERNOON SESSION.

(Commencing at 2 p.m.)

An address will be given by Sir William Dawson, Principal of McGill University, Montreal, to be followed by a paper by Prof. W. C. Carlyle on the subject of "Technical Education in its relation to Mining;" "Platinum, its mode of occurrence, and uses," by J. T. Donald, M.A., and papers by Capt. Robert C. Adams, Montreal; Dr. Robert W. Ells, Ottawa, and E. D. Ingall, M.E., Ottawa.

THE ANNUAL DINNER.

The annual dinner of the Association will be held in the Windsor Hotel in the evening at 9 o'clock. Tickets may be obtained from the Secretary, or Mr. A. W. Stevenson, C.A., Montreal, or members of the Council. Tickets (exclusive of wines), $3.00.

GEO. IRVINE, *President,*
B. T. A. BELL, *Secretary.*

Montreal. Mr. Rutherford, we very much regret to say, has recently been affected to some extent in his hearing, and is consulting Dr. Buller. We are sure that every one of Mr. Rutherford's many friends wish him a speedy recovery.

Mr. J. Lainson Wills, F.C.S., Ottawa, manager of the General Phosphate Corporation, left for England on Thursday, 3rd inst., to attend the annual meeting of his company on 22nd.

Captain Richard Penhale, superintendent of the Albert Mines, is still in New York.

Mr F. J. Falding, M.E., manager of the Moulton Hill and Howard Pyrite Mines in the Townships, has gone to the head office of his company at Cleveland, O.

Mr. W. H. Irwin, managing director of the Anglo-Canadian Asbestos Co., is now in England to attend the annual meeting of the company.

Mr. E. Grant Powell, the first editor of the REVIEW, now a resident of London, Eng., has been visiting his home in Ottawa during the month. Mr. Powell sailed for England on the 5th.

Mr. J. Keith Reid, manager of the Ross Mountain phosphate property, has gone to England on a brief business trip.

INDUSTRIAL.

Lidgerwood Manufacturing Company, New York.—This enterprising New York company has issued a very handsomely engraved brochure illustrating several of their hoisting and conveying devices, utilized in raising American phosphates. One of the features of this handy little reference is the description of the Locke-Miller patent horizontal cableway. As shown in the engravings two "A" frames or towers are located on the banks of the mine or pit, usually about 500 feet apart. These support a main cable whose ends are securely anchored in the ground. The cable forms a track way for supporting a travelling carriage, from which depends a fall block that rises and falls at the will of the engineer. The load is carried in self-dumping buckets, which hang from the fall block. Two moving ropes are employed in this cableway, one to hoist, called the hoisting or "fall rope," the other to give the horizontal movement to carriage, and is called the endless or traversing rope. This cableway is universal in its movements; the load may be lifted from any point and delivered to any point without shifting stops or catches. No lock or trip is used in connection with it. We strongly recommend our readers, particularly asbestos and phosphate producers, to write to the Lidgerwood Co. for a copy of this pamphlet.

The Dodge Wood Split Pulley Co., of Toronto, have lately furnished the new shops of the Canadian Pacific Railway Co., at Toronto Junction, with an interesting piece of power transmission. The drive in this instance being the conveyance of 35 h.p. from the driving wheel on engine, to the line shaft in wood working shops, a distance of some 460 feet. The transmission consists of a system of ground pulleys and a double warp of 1″ Diam "Firmus" rope, which is carried over the intervening roofs and yard by means of idler pulleys placed at given points between the span, and which are all neatly housed in for protection from weather. The ropes, however, run out of doors without further protection than a good coating of patent rope dressing, all stretch and shrinkage being directly controlled by the patent take-up device which is controlled in Canada by the Dodge Co. The power is conveyed in a positive and noiseless manner and to the entire satisfaction of the railway company's superintendents. The Dodge Co. invite all who are interested in the economical transmission of power to a distance, to see this drive.

Canadian Rand Drill Company.—During the month we had the pleasure of paying a visit, in company with Mr. F. A. Halsey, the manager, to these excellent machine shops at Sherbrooke, Que. The Rand Drill Co. has equipped its Canadian establishment with a first class working plant, and in consort with the Jencke's Machine Co., now turn out a large and increasing business in mining and quarrying equipment. In our next issue we hope to reproduce a photograph of the large winding engine made in the shops for the Drummond colliery at Westville.

SITUATION WANTED.

MECHANICAL ENGINEER of large and varied experience in England and this country is now open to engagement. Fully qualified to open and equip mines. Best of references and testimonials.

Address
ENGINEER,
Canadian Mining Review,
Ottawa.

NORTH-WEST MOUNTED POLICE

RECRUITS.

APPLICANTS must be between the ages of Twenty-two and Forty, active, able-bodied men of thoroughly sound constitution, and must produce certificates of exemplary character and sobriety.

They must understand the care and management of horses, and be able to ride well.

The minimum height is five feet eight inches, the minimum chest measurement 35 inches, and the maximum weight 175 pounds.

The term of engagement is five years.

The rates of pay are as follows :—

Staff-Sergeants	$1.00 to	$1.50	per day.
Other Non-Com. Officers	85c. to	1.00	do

	Service pay.	Good conduct pay.	Total.	
1st year's service	50c.	——	50c.	per day.
2nd do	50c.	5c.	55c.	do
3rd do	50c.	10c.	60c.	do
4th do	50c.	15c.	65c.	do
5th do	50c.	20c.	70c.	do

Extra pay is allowed to a limited number of Blacksmiths, carpenters and other artizans.

Members of the force are supplied with free rations, a free kit on joining, and periodical issues during the term of service.

Applicants may be engaged at the Immigration office, Winnipeg, Manitoba; or at the Headquarters of the Force, Regina N. W. T.

Latest Stock Quotations of Canadian Companies in England.

	Price.	
Nicola, Limited, £35,000 fully-paid shares of £1	——	
Shuniah Weachu, Limited, £99,888 fully-paid shares of £1	——	
Tilt Cove Copper, Limited, £160,000 fully-paid shares of £2	——	
Ditto, £80,000 5½ per cent. debentures	——	
General Mining, Limited, £219,752 fully-paid shares of £8	3¾	4¼
Low Point, Barrasois and Lingan, £509,100 fully-paid shares of £100	——	
New Vancouver Coal Mining and Land, Limited, £185,000 fully-paid shares of £1	⅝	⅞
Sydney and Louisburg Coal and Railway, Limited, £50,000 cumulative 10 per cent. first preference shares of £10, £6 paid	4	6
Ditto, £14,560 fully-paid non-cumulative 6 per cent. second preference of £10	3	5
Ditto, £250,000 fully-paid ordinary shares of £10	¼	¾
Anglo-Canadian Asbestos, Limited, £11,500 fully-paid shares of £1	——	
Anglo-Canadian Phosphate, Limited, £46,510 fully-paid preference shares of £10	——	
Ditto, £25,000 fully-paid deferred shares of £10	——	
Bell's Asbestos, Limited. £140,000 fully-paid shares of £5	7	7¼
Ditto, £68,400 debentures, 5 per cent.; interest January 1 and July 1	——	
Canadian Phosphate, Limited, £100,000 fully-paid shares of £1	⅛	¼
General Phosphate, Limited, 5 per cent. ordinary shares of £10, £2 paid	——	
Ditto, £5,000 fully-paid founders' shares of £10	——	
Leeds, Copper, Limited, shares of £1, with 10s. 6d. paid	——	

Nicola.—Accounts to September 30 submitted in November. No dividend yet. Further capital is needed; and operations temporarily suspended.

Shuniah Weachu.—Accounts to November 20 submitted in February. No dividend yet. Shares for £12,870 held by the Company.

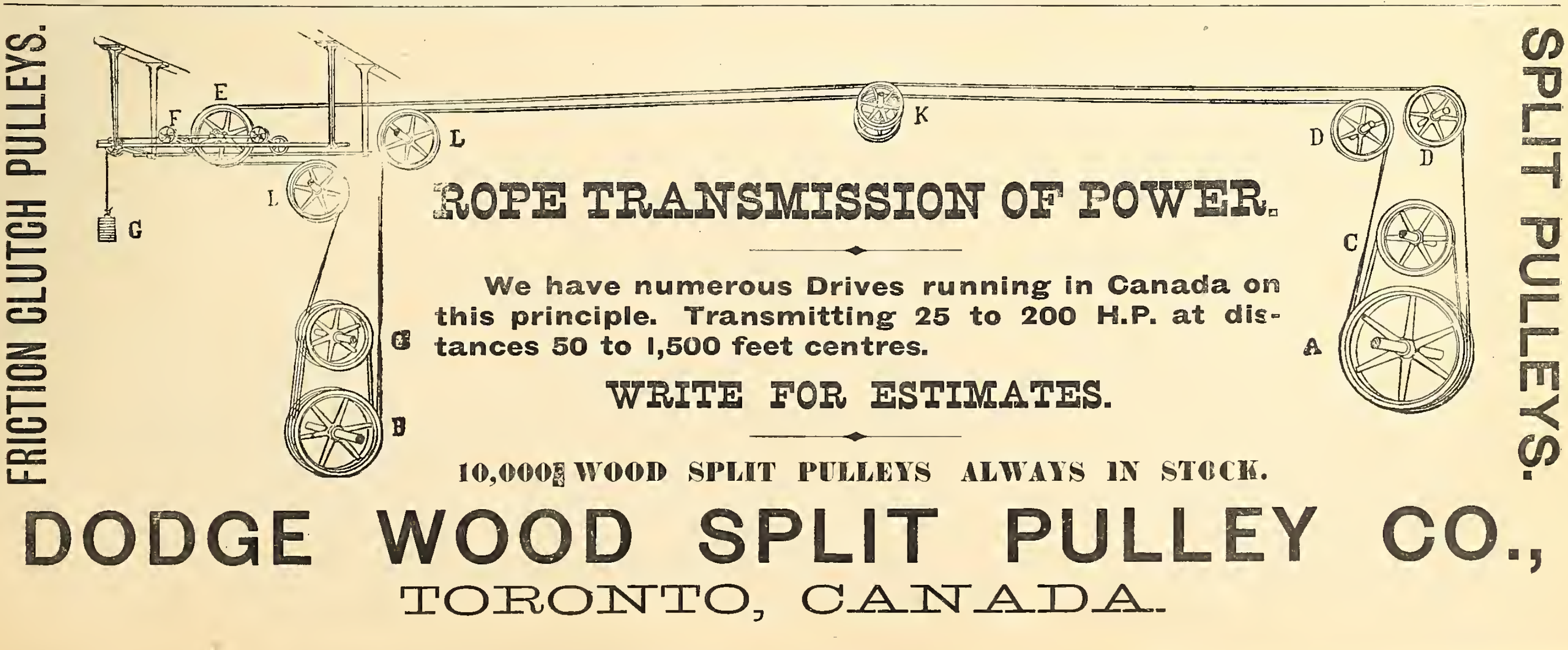
Tilt Cove.—In March, 1890, the properties were leased for 99 years to the Cape Copper Company, Limited, at a rent of £4,400. The Cape Copper Company advance £15,000 at 5 per cent. interest, and when this is repaid out of profits, surplus profits are to be divided equally between the Cape Copper Company and the Tilt Cove Company. The lease may be determined by the Cape Copper Company at any time on twelve months' notice. Accounts annually to March 31 submitted in November.

General Mining.—Accounts to December 31 submitte in April, but an interim meeting is held in November. Dividend for 1884, 5 per cent.; for 1885 and 1886, 3⅛ each year; for 1887, £4 13s. 9d. per cent., and for 1888 1889 and 1890, 3¾. Reserve fund, £29,850.

Low Point.—Accounts to December 31. For 1887, 1888, and 1889, 5 per cent was paid each year on the ordinary shares publicly held; for 1888 the ordinary shares issued to the vendors got 3½ per cent., and for 1889, 2½.

New Vancouver Coal.—Reconstructed in 1889. Accounts to June 30 and December 31 submitted in November and May. For the two half-years to June, 1889, 5 per cent. per annum was paid; to December, 1889, 4 per cent.; and to June and December, 1890, 6 per cent. Reserve fund, £10,000. Debentures, £60,000.

Sydney and Louisburg Coal.—Accounts to December 31 submitted about May. In respect of 1889 15 per cent.



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WRITE FOR ESTIMATES.

10,000 WOOD SPLIT PULLEYS ALWAYS IN STOCK.

DODGE WOOD SPLIT PULLEY CO.,
TORONTO, CANADA.

was paid on the first preference, and for 1890, 10 per cent., leaving arrears of 50 per cent.

Anglo-Canadian Asbestos.—Reconstructed in 1889. Accounts to December 1st submitted in April. At general meeting held on 16th April, a dividend at the rate of 20% per annum was declared. Debentures, £3,450.

Anglo-Canadian Phosphate.—The preference shares rank first for 7 per cent., and after a like rate has been paid on the deferred shares, both classes rank equally. Accounts to November 30, submitted in May. No dividend yet on either class. Debit to profit and loss on November 30, 1890, £5,749.

Bell's Asbestos.—Accounts to December 31 submitted in January. Dividends for 1888 and 1889, 22½ per cent. each year; 1890, 15 per cent. Reserve, £45,000. The debentures are redeemable by 1913, by annual drawings at 115 from a sinking fund, which the directors may increase.

Canadian Phosphate.—Accounts to November 30 submitted in February. The working of the eleven months to November 30, 1888, resulted in a profit of £2,576, which was carried forward. A dividend of 6d. per share was paid November 1, 1891.

General Phosphate.—Registered June 13, 1890. To acquire properties in Canada and elsewhere. The founders' shares take one half the profits after providing for ten per cent. dividends on the ordinary.

Leeds Copper.—Registered January 16, 1891. To take over the properties of the Excelsior Copper Co., (Ltd). Authorized capital, £450,000. Accounts to Dec.

◆

Natural Gas Constantly Forming.

Professor W. J. McKee, of the U. S. Geological Survey, in a Washington paper, recently made the following observations regarding Indiana's natural gas supply :—

"The origin of the rock gas and petroleum, as well as the laws by which they are accumulated, is so well understood that it is as easy to predict the success or failure of a prospective bore for oil or gas as to tell where an artesian well will or will not fetch water. Scientific investigation has made known the cause of the tremendous pressure under which the gas and oil are confined. Every great field in Pennsylvania, Ohio and Indiana is an enormous dome beneath the surface of the ground, filled in with porous sandstone or limestone. The natural gas of Indiana is in such a dome, about fifty miles across, formed by the bending out of shape of the strata incidentally to the contraction of the earth's crust. The coarse-grained limestone that is under it is charged with inflammable fluids. On top is gas, beneath it oil, and under the oil is salt water. This dome runs in the middle of a great basin 500 miles in diameter. The rain water falling into this basin is partly absorbed by the rocks, and it floats from all directions toward the centre, driving the oil and gas which are in the rocks towards the dome, and thus compressing it with enormous power.

"Rock gas is the same thing as marsh gas, which is often seen bubbling from the muddy bottoms of stagnant ponds. It, and the oil likewise, were formed originally by the slow decomposition of woody or other organic matter contained in the strata of the earth. The making of both is now in progress in all rocks containing partly decomposed organic remains. The question is often asked, 'Is natural gas yet forming?' Undoubtedly. It is only a question of the formation being equal in localities to the drain of consumption.

"All the compounds of carbon upon which the civilized world chiefly depends at present for fuel must be exhausted within a few centuries. The anthracite of America will be used up in a few decades, while the bituminous coal-beds formed in the carboniferous and cretaceous epochs, will be dug out within 1,000 or 2,000 years. Happily, however, the stock of bitumens in the rocks of the earth is practically unlimited, and in them will be found the fuels and illuminants of the future."

◆

The Noble Gold Milling Process.

A new process which, according to the *Australian Mining Standard*, bids fair to be of great importance in gold milling is about to be introduced by the Noble Mining and Milling Company, of New York, a company recently organised for its exploitation. The process, which is the invention of the late Mr. B. G. Noble, ex-Governor of Wisconsin, an experienced chemist, who spent many years upon its development, is designed, our contemporary states, to save the very fine gold occurring in certain ores, much of which is lost as "float" in the ordinary process of plate amalgamation. This *desideratum* is accomplished by intermixing the pulp and mercury to a degree hitherto unattainable on account of the danger and consequent loss of flouring the mercury, this difficulty being overcome in the Noble process by the addition of a chemical which has the effect of coalescing the almost infinitesimally fine particles of floured mercury. A series of tests with the process, which has been conducted at the company's testing works, near New York, upon a working scale during the past six months, has given extremely successful results. By the Nobie process the auriferous ore is ground so as to pass a 100-mesh sieve, a Fuller mill having been used for this purpose at the experimental works. The pulp, with the necessary amount of mercury for the amalgamation of its gold contents, is then run into a tub called the amalgamator, which is equipped with a stirrer suspended near the iron bottom of the vessel. The tub, which is 42 inches in diameter, has a capacity of ½ ton of pulp at a charge. The charge having been run into the amalgamator, the mercury-coalescing chemical, the nature of which is kept a secret, is added, and the stirrer put in motion, rotating at 250 revolutions per minute, the presence of the chemical preventing the flouring of the mercury. During this operation, which lasts 15 minutes, the particles of pulp are brought into contact with those of mercury in the most thorough manner, and the amalgamation is effected. The pulp is then drawn off into a settler, little different from those of the ordinary type, and diluted, whence it is drawn into a second settler and further diluted, from which the tailings are allowed to run away. In the tests which have been made various lots of ore, principally from North Carolina mines, have, the Australian *Mining Standard* states, been run. Ore from one mine which is now being regularly worked by plate amalgamation, furnished the best comparative results. It was a free milling ore, containing a very small amount of pyrite, assaying from 8s. to 16s. per ton. On the plates but 24 per cent. of the gold value was recovered, while by the Noble process as much as 93 per cent. was saved. Equally satisfactory results have been obtained from pyritous ores. The loss in mercury in experimental runs has been about ½ lb. per ton; in continuous runs this would, of course, be considerably smaller. It is claimed that in a 25 ton plant the process can be worked for 4s. per ton.

PROVINCE OF NEW BRUNSWICK.

Synopsis of "The General Mining Act," Chapter 16, 54th Victoria.

—LEASES FOR MINES OF—

GOLD, SILVER, COAL,
IRON, COPPER, LEAD,
TIN and PRECIOUS STONES.

GOLD AND SILVER.

PROSPECTING LICENSES up to 100 areas, (each 150 feet by 250 feet), issued at 50 cts. an area up to 10 areas, and 25 cts. afterwards per area, good for one year. These Licenses can be renewed for second year, by payment of one half above amount.

LEASES for 20 years to work and mine, on payment of $2 an area of 150 feet by 250 feet. Renewable annually at 50 cts. an area in advance.

Royalty on Gold and Silver, 2½ per cent.

MINES, OTHER THAN GOLD AND SILVER.

LICENSES TO SEARCH, good for one year, $20 for 5 square miles. Lands applied for must not be more than 2½ miles long, and the tract so selected may be surveyed on the Surveyor General's order at expense of Licensee, if exact bounds cannot be established on maps in Crown Land Office. Renewals for second year may be made by consent of Surveyor General, on payment of $20.

Second Rights to Search can be given over same ground, subject to party holding first Rights, on payment of $20.

LEASES.—On payment of $50 for one square mile, good for two years, and extended to three years by further payment of $25. The lands selected must be surveyed and returned to Crown Land Office. Leases are given for 20 years, and renewable to 80 years. The Surveyor General, if special circumstances warrant, may grant a Lease larger than one square mile, but not larger than two square miles.

ROYALTIES.

Coal, 10 cts. per ton of 2,240 lbs.
Copper, 4 cts. on every 1 per cent. in a ton of 2,352 lbs.
Lead, 2 cts. on every 1 per cent. in a ton of 2,240 lbs.
Iron, 5 cts. per ton of 2,240 lbs.
Tin and Precious Stones, 5 per cent. of value.

APPLICATIONS can be fyled at the Crown Land Office each day from 9.30 a.m. to 4.30 p.m., except Saturday, when Office closes at 1 p.m.

L. J. TWEEDIE,
Surveyor General.

Hand-power Diamond Boring Machine.

In *Oesterreichische Zeitschrift fur Berg-und Huttenweesen* Mr. E. Nordenstrom writes; "The use of bore-holes in underground workings for the discovery of ore deposits, has been practised in Sweden for a considerable time. Thirty or forty years ago the maximum distance attainable by percussion hand-boring was 44 feet. In 1872 the method of diamond-boring was adopted in coal-bearing rocks in Scania, and about 1,100 yards of borings were made by foreign companies at an average cost of £6 5s. per yard, for which price shafts could have been sunk in the same ground. Subsequently an American prospecting machine, driven by compressed air, was adopted in the Norberg mines, where a bore, inclined upwards at a slope of 1 in 100, was driven a distance of 33 yards through granite, felstone and limestone. The average length driven per shaft was 8 feet 8 inches, the maximum of 16 feet having been obtained in limestone. About 220 yards of borings were done in the district at an average rate of 7·73 feet per shift, but the cost was still almost the same as that for which levels could be driven at the rate of wages current in the locality, so that the only saving was in time.

In 1887 a light, simplified manual power machine was introduced. The bore-rods are iron tubes, 1·29 inch external, and 0.98 inch internal diameter, and five feet long, screwed together. Eight diamonds—four inside and four outside—are used in the boring head, which is of 0·94 inch bore, giving cores of 0·86 inch diameter. The average weight of the diamonds was between 0·75 and 0·8 carat each, and the cost last year about £2 14s. per carat. The total weight of the machinery, including 55 yards of rods and the force pump and gear for flushing the hole, is 14 to 15 cwt.

Up to the end of 1888, a total length of 3,250 yards had been carried out by these machines, the longest bore being 200 feet from the face. Most of the borings have been underground, 25 per cent. being vertically downwards, 37 per cent. nearly horizontal, and 38 per cent. varied between 58° upwards and 78° downwards. From four to six men are required for working the machine, and about 1¼ gallons of water per minute is needed for flushing out the hole. The rate of advance per shift of 8 to 9 hours, varied from 2½ to 4¾ feet. The total cost is from £1 6s. 6d. to £1 8s. 6d. per yard, while that of driving levels, including the lifting of the debris to the surface, varies from £2 15s. per yard in ordinary, to £3 17s. 6d. per yard in very close ground.

Money Orders.

MONEY ORDERS may be obtained at any Money Order Office in Canada, payable in the Dominion and Newfoundland; also in the United States, the United Kingdom, France, Germany, Austria, Hungary, Italy, Belgium, Switzerland, Portugal, Sweden, Norway, Denmark, the Netherlands, India, Japan, the Australian Colonies, and other Countries and British Colonies generally.

On Money Orders payable within Canada, the commission is as follows :

If not exceeding $4	2c.
Over $4, not exceeding $10	5c.
" 10, " " 20	10c.
" 20, " " 40	20c.
" 40, " " 60	30c.
" 60, " " 80	40c.
" 80, " " 100	50c.

On Money Orders payable abroad the commission is :

If not exceeding $10	10c.
Over $10 not exceeding $20	20c.
" 20 " " 30	30c.
" 30 " " 40	40c.
" 40 " " 50	50c.

For further information see OFFICIAL POSTAL GUIDE.

Post Office Department, Ottawa.
1st November 1889.

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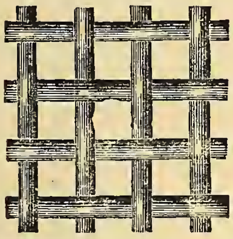

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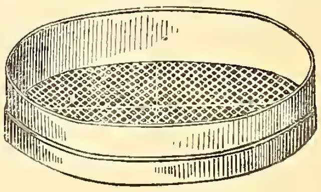

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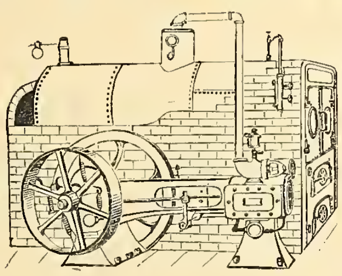

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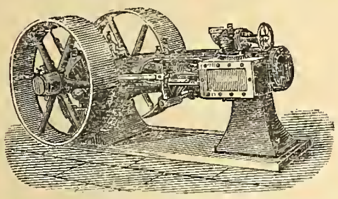

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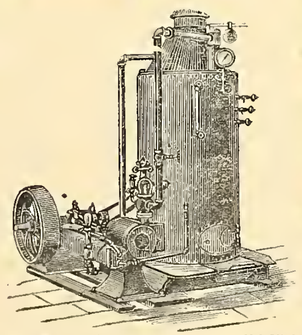

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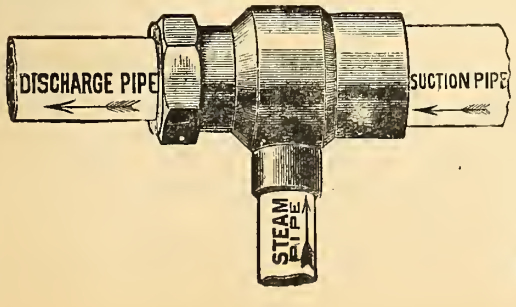

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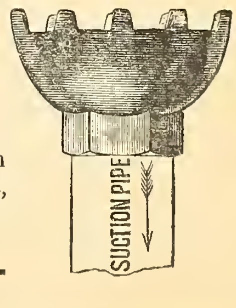

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SECOND YEAR OF PUBLICATION.

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A careful digest of information compiled from the most authentic sources relating to the Organization, History and Operation of all Canadian Mining and Quarrying Companies, together with a series of articles on the leading mineral industries of Canada, and a Resume of the Federal and and Provincial Joint Stock Companies Acts.

EDITED AND COMPILED BY

B. T. A. BELL, EDITOR OF THE CANADIAN MINING AND MECHANICAL REVIEW.

Secretary General Mining Association of the Province of Quebec, &c.

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The Canadian Asbestos Industry.
Gold Mining as an Industry in Nova Scotia.
Coal and Iron in Nova Scotia.
The Early History and Development of the Coal Trade in Nova Scotia.
Our Gold Fields in Quebec.
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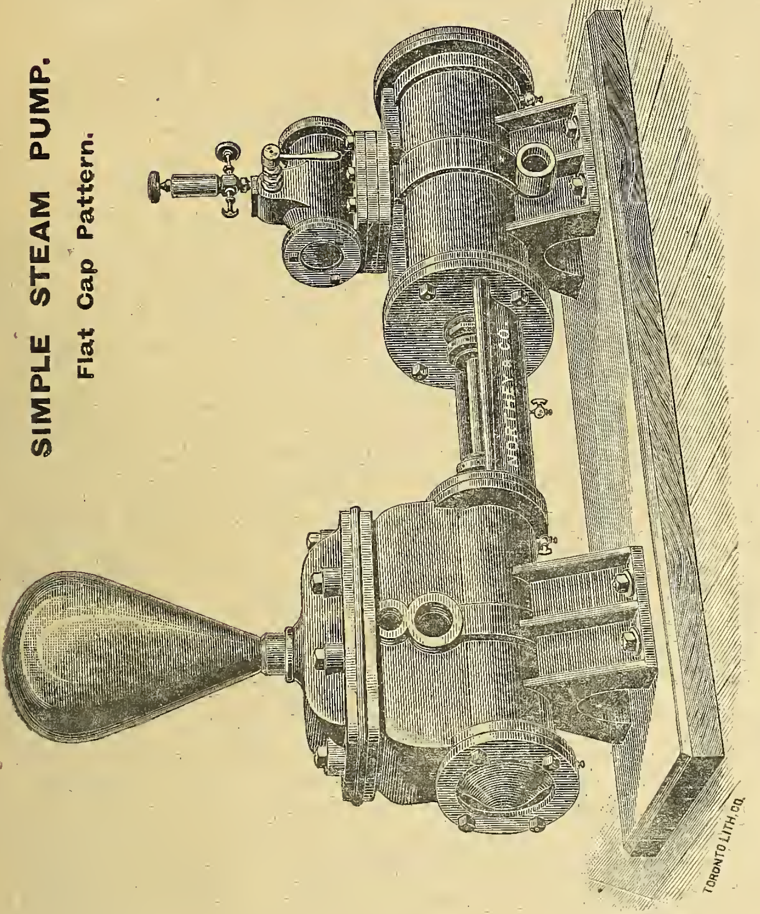

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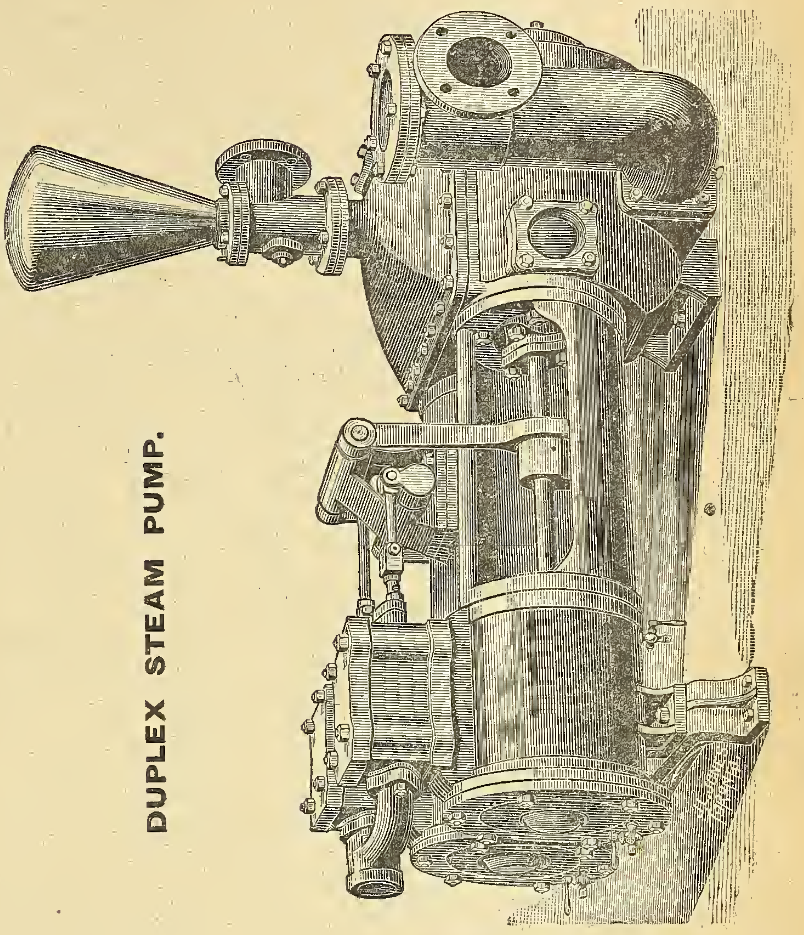

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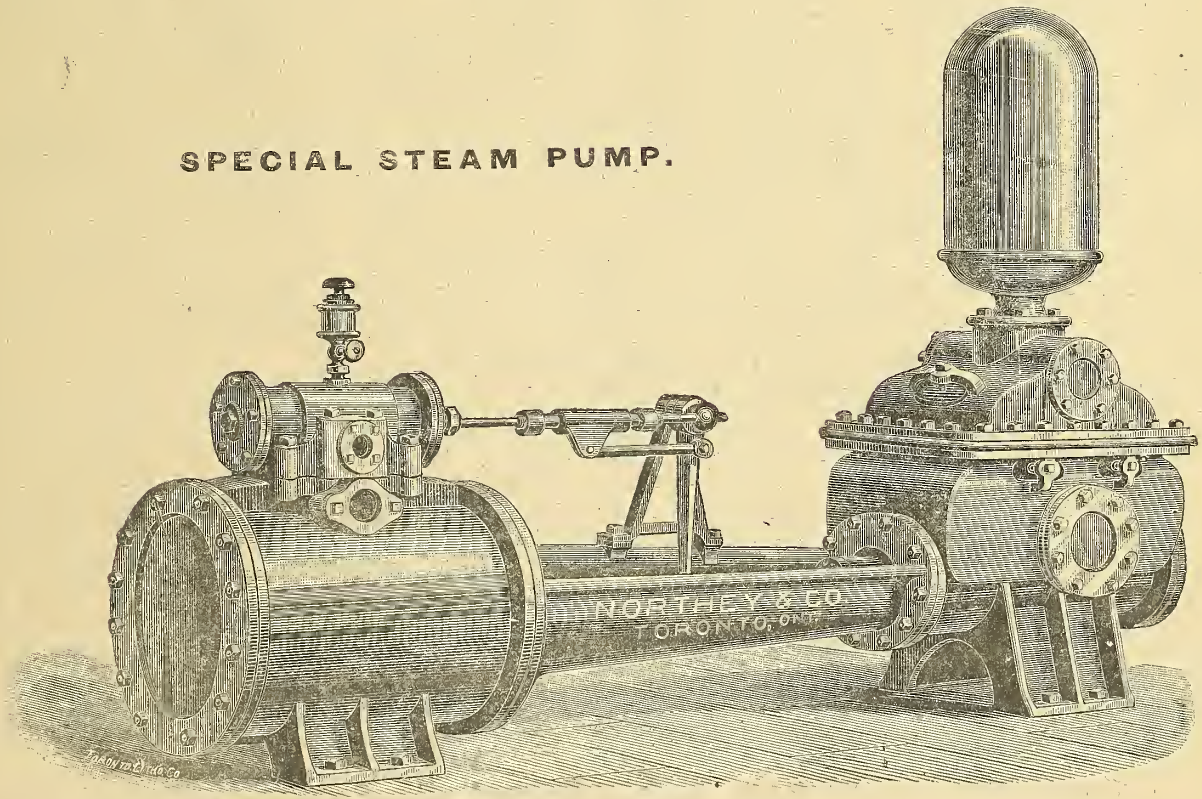
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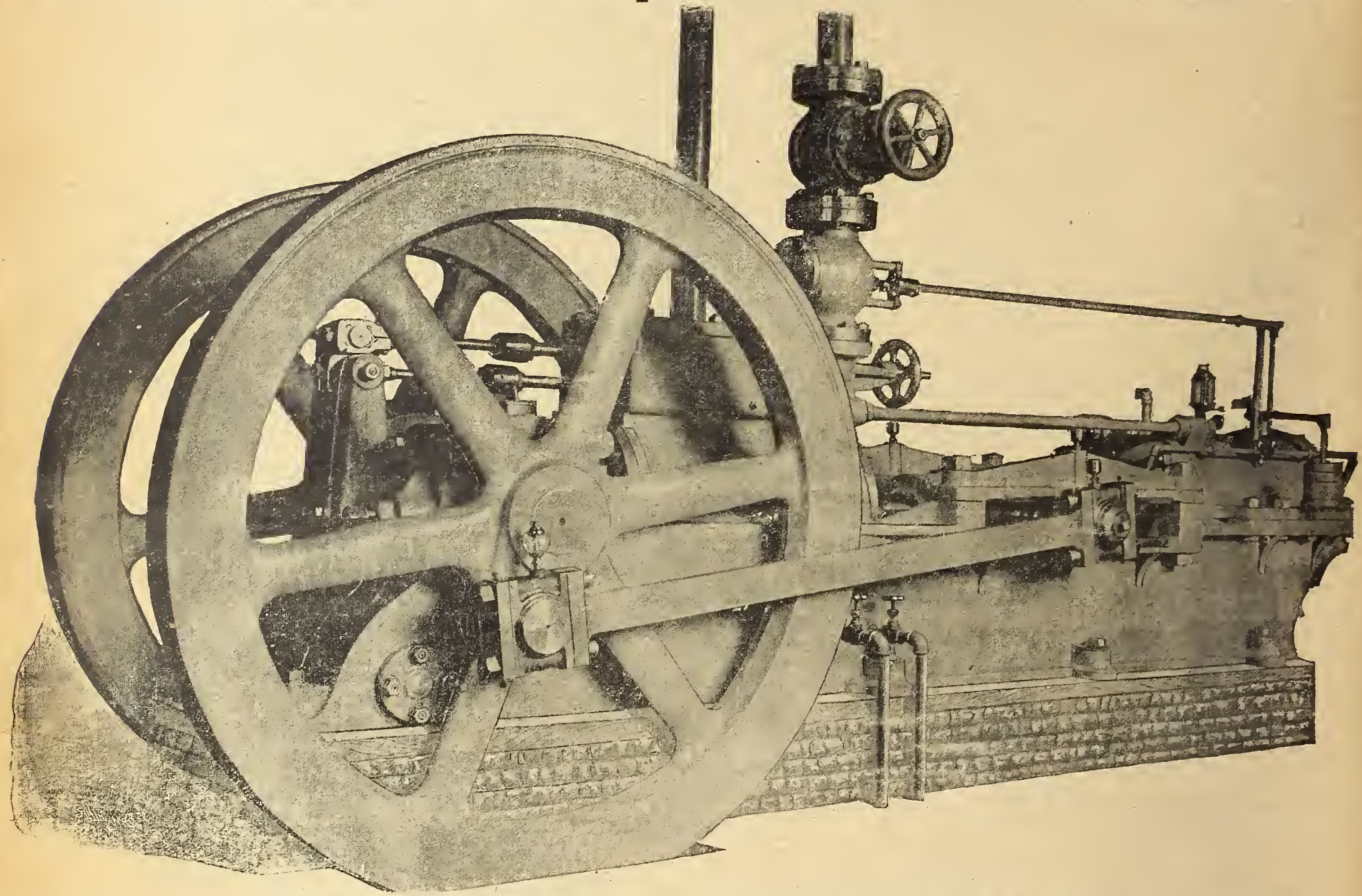

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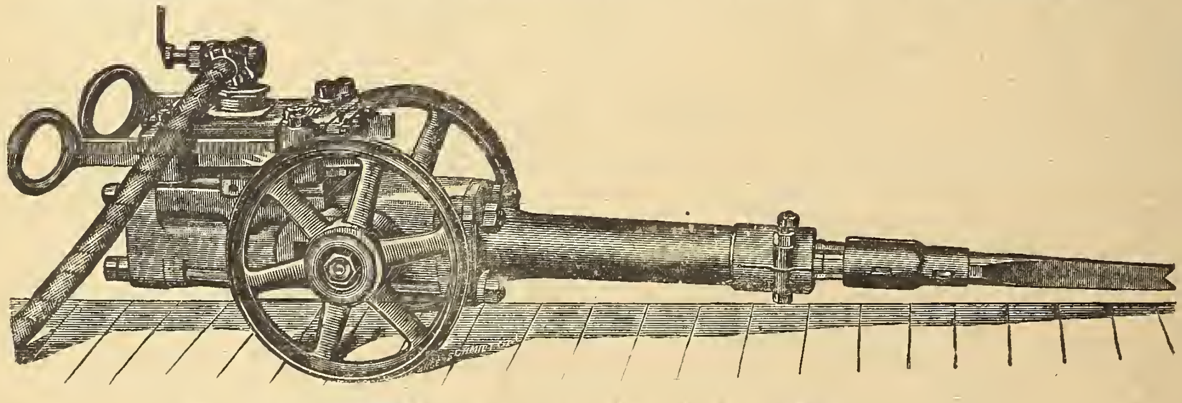

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